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Outdoor Substations in Connection with Coal-Mining Installations

General Requirements and Station Design — High-Tension Current Control — Salient Considerations

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DEVELOPMENT of high-tension outdoor substations during the past few years has been due primarily to economic reasons. The demand for power in small communities could not be met with the conventional and comparatively expensive indoor types unless the rate for service was materially increased. That the various problems incident to development have been solved successfully, it is only necessary to point to the wide adoption of outdoor substations by utility companies. Passing at once to the question as to whether outdoor substations are applicable to the power requirements of coal mines, it

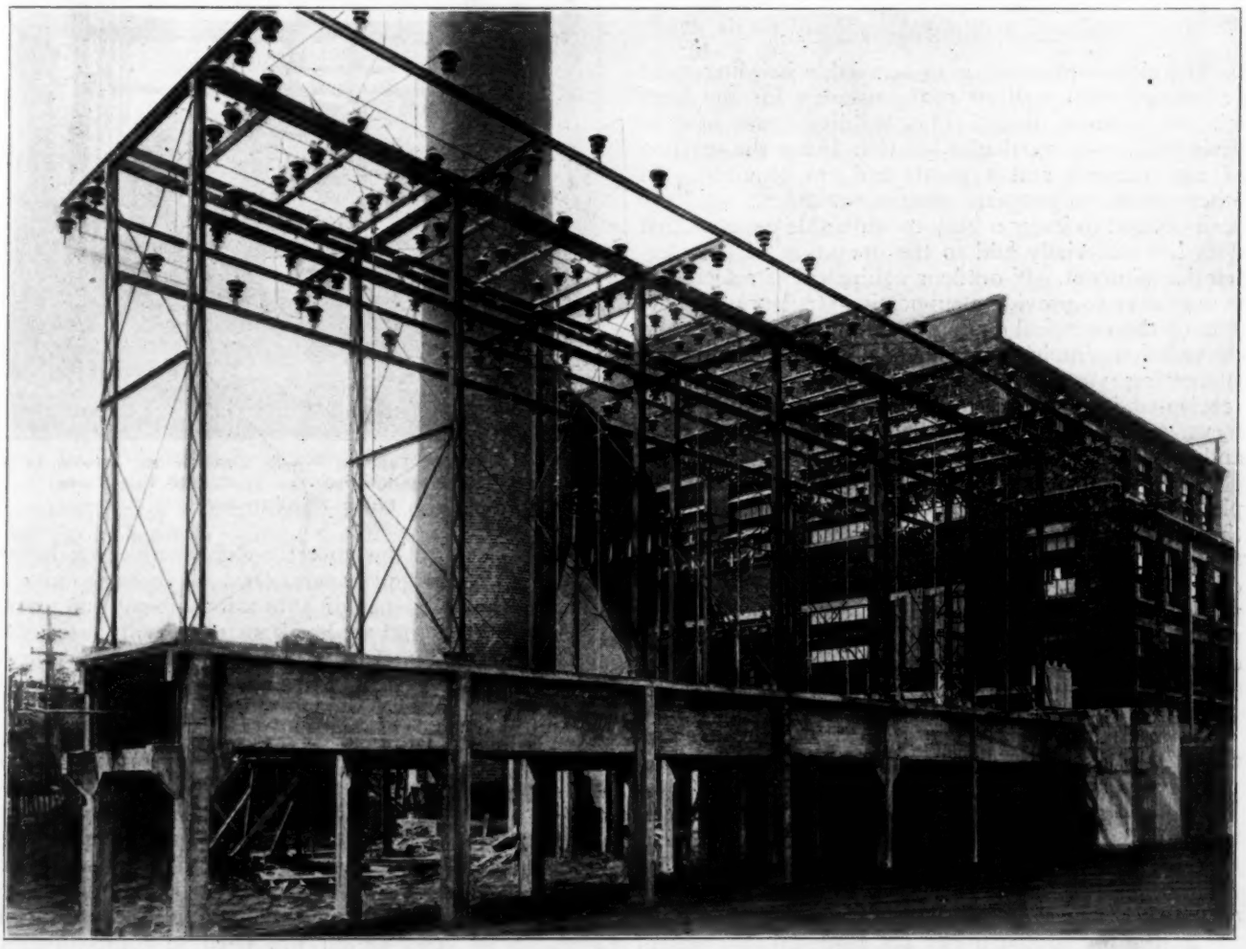

Fig. 1.—33,000-Volt Stepup Outdoor Substation Installation Outside a Power House Generating at 2300 Volts Stepping Up to 33,000. Twenty-one Coal Mines Are Supplied From Lines Leading From This Installation.

is well to consider first the elements entering into their construction.

Self-cooled outdoor transformers are no longer an experiment. The chief difference between an indoor and an outdoor transformer is in the type of bushings and cover. The outdoor type is commercially available in any desired capacity or voltage.

There are two distinct types of high-tension switches, the oil-break and the air-break forms. The oil-break switches are simply a development of the indoor types, the principal difference being in housings and terminals. They are thoroughly developed and in successful operation. Air-break switches are an accepted standard for transmission systems and are available in several forms. When provided with arcing horns or discharge horns, they can be used to open loaded circuits.

Lightning Arresters, Choke Coils, Fuses and Wiring Supports.

Outdoor types of electrolytic, oxide film and horn-gap arresters with or without limiting resistance are fully developed and have good service records. Outdoor choke coils are of the same general design as the indoor type with the exception of the insulating supports. The modern high-tension fuses can be used equally well indoors or outdoors, the only difference being that the outdoor mountings have petticoat instead of pillar-type insulators. High-tension wiring supports are standard commercial devices. Like the indoor types, they are made in many forms and assembled to meet the various wiring conditions.

Construction Requirements.

If indoor equipment is to be used, a building must be erected with wall or roof bushings for the high tension incoming lines. This building must first be designed for the particular location, hence the services of an architect and a contractor are required. In other words, to properly protect equipment, we have been obliged to incur a very considerable expense that does not materially add to the operation of the electrical equipment. If outdoor equipment is selected, it is necessary to provide a supporting structure for only part of the electrical equipment; the transformers and oil switches simply requiring a foundation slab. The supporting structure is composed of steel sections fabricated in a factory and shipped with the equipment, thus eliminating the expense of the architect and contractor, necessary with the indoor station.

The outdoor substation steel structures are of simple design and can be erected by common labor under the direction of a foreman connected with the electrical department of the mine. The steel-tower outdoor substation does not require much foundation preparation but can be erected on small concrete pillars on the side of a hill, on a piece of waste ground, or at points not suitable for other purposes.

General Design.

The general design of outdoor substations has been thoroughly standardized, the actual assembly of elements depending upon local conditions to be met. Where two sources of power, such as a double-circuit transmission line, are available, proper switching arrangements must be provided. A standard design for connecting transformers to either or both of two parallel and synchronous lines is shown in Fig. 3.

At the top of the tower are mounted two sets of three-pole, double-break-per-phase, air-break switches provided with separate interlocked operating mechanisms. Each switch has its own operating shaft and a handle so located that opening and closing the switch can be accomplished from ground level. In the high-tension side of the transformer wiring are located three single-pole combination choke coil and fuse units. On the opposite side of the tower are mounted three fused disconnecting switches connected to the separately mounted three-phase lightning arresters. From the one line diagram, the connections can be easily traced. The choke coils are so located that incoming high voltage surges or lightning disturbances are reflected to the arresters, where they will be discharged in the usual manner.

An important feature of this design is in the elimination of an expensive automatic oil circuit breaker on the high-tension side. That this saving can be made without jeopardizing the transformers is not generally understood by purchasers who often needlessly specify their use. It is essential that the expense be kept to the lowest possible value consistent with safety and good operation. As there is quite a difference in the cost of substations using automatic circuit breakers and air-break switches with fuses, the question immediately arises as to whether we can afford to use this lower cost equipment.

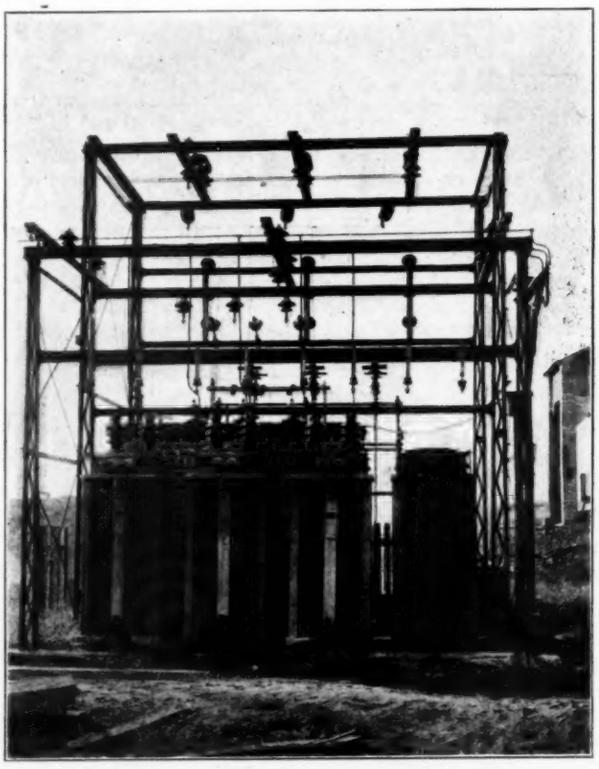

Fig. 2.—Substation Tapping Power Line Giving Service to a Coal Mine Containing 900-kw. 33,000/2300-Volt Three-Phase Transformer.

Damage Caused by Short Circuits.

It is conceded as a fact that the severity of damage done to transformers during short-circuit condition is in direct proportion to the amount of energy flowing into the circuit before the transformers are disconnected. Whether an automatic oil switch or fuse will clear the short circuit in the least time can be answered as follows: High-tension automatic oil switches of good design will open in approximately 0.16 sec. under short-circuit conditions. High-tension fuses of good design will clear short-circuits in ap-

proximately 0.013 sec. or from ten to twelve times as rapidly as the automatic oil switches.

High-tension fuses will, under short-circuit conditions, permit a current flow many times the full load rating. Assuming that the current flow with automatic oil switches will be no greater and by comparing the time elements of the fuses (0.013 sec.)

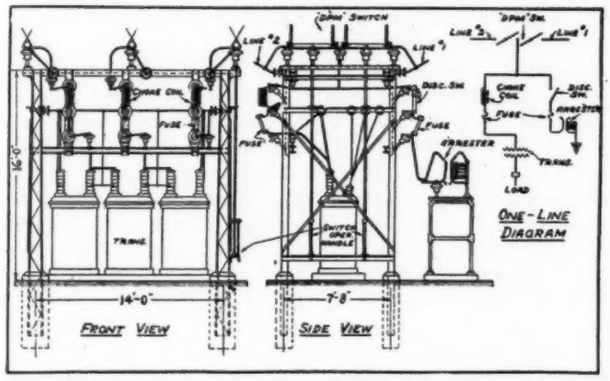

Fig. 3.—Steel Tower Substation with Transfer Type Switches for Connecting Transformers to Either or Both of Two Parallel and Synchronous Lines.

and the time element of the automatic oil switches (0.16 sec.), it follows that the slower operating switch will allow approximately twelve times more energy to flow into a short circuit than will flow with the faster operating high-tension fuse. In considering the above values, it should be borne in mind that the amount of reactance in the circuit including that of the transformers, will limit the actual flow with either device.

Over-fusing the Substation.

The exceptionally rapid action of fuses will therefore permit overfusing the transformers theoretically twelve times the normal current and still secure protection equal to that of an automatic oil switch. In actual practice overfusing from three to ten times normal is used depending upon local conditions. For power circuits subject to wide fluctuations, such as mining loads, high-tension circuit-opening devices should be so rated or adjusted that they will not operate except in case of actual trouble, such as transformer failure, and such cases are rare with modern transformer designs.

Such overload protection as is desired can be secured easily and cheaply by means of a low-tension automatic oil switch installed on the secondary side of the transformer bank. In substation practice, this combination of heavy high-tension fuses on the primary side, which will only open in case of transformer failure, and a properly adjusted oil circuit breaker on the secondary side of the transformer bank is an excellent protective system often taken advantage of.

The high-tension automatic oil switch has the advantage that it can be used for switching in addition to the overload feature. When fuses are used, it is necessary to install an air-break switch to disconnect the transformers from the line. In actual practice, however, it is often advisable and is considered good engineering practice to install disconnecting switches between the oil switch and the line. The reason for this is that the oil-switch contacts are necessarily concealed in the tanks and to be absolutely sure that a line is clear the disconnecting switches should be opened, thus giving the operator ocular evidence of disconnection.

Should the oil switch open frequently or under severe load conditions, it is advisable to inspect the contacts, oil levels, and condition of the mechanism. To enable inspection adjustments or repairs, it is often advisable to install auxiliary disconnecting switches so connected that the oil switches can be shunted and

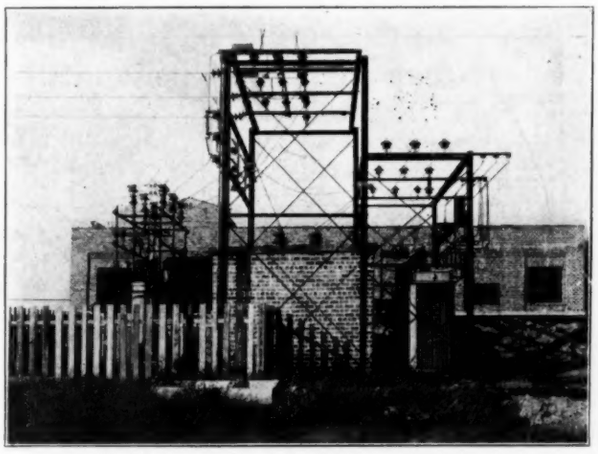

Fig. 4.—1200-kw. 33,000/2300-Volt Three-Phase Substation.

entirely disconnected from the circuit, power being temporarily delivered through the auxiliary switches.

Another point in favor of the oil switch is that after interruption it can, if in good condition, be immediately closed, thus reducing the time of service interruption. It will naturally require more time to open an air-break switch and replace fuses than it will to close the oil switch. The saving of a moment's time may in some instances warrant the additional expense of the oil switch. However, the average high-tension substation attendant, especially if not "hardened" by long experience, will after an interruption be inclined to go slow in closing the switch until he can actually view every possible part of the switch mechanism, assuring himself that it is in condition to resume service.

The fuse and air-break switch combination has, therefore, a certain advantage in that every part of the units, including contacts and condition of fuses, are in plain view of the attendant. The average man working on high-tension equipment has considerably more confidence if he can, without a shadow of a doubt, determine its condition at all times. The choice of equipment must finally rest with the purchaser but as a guide in determining in a general way the dividing line between the use of high-tension fuses and oil breakers, the following tabulation of substation capacities on which fuses can be advantageously used is given, when automatic oil breakers are installed on the low tension side.

Primary voltage.	Transformer capacity, kv-a.	Full load current per phase, amperes.	Rated capacity of fuses.
13,200	1000	43.7	200
22,000	1500	39.3	200
33,000	2000	35.0	175
44,000	2500	32.8	150
66,000	3000	26.2	100

When but a single source of power is used, the substation is simplified by omitting one of the three-pole air-break switches shown in Fig. 3. A typical design having but one source of power is shown in Fig. 6.

A recent coil mine installation made by Carl

Scholz, consulting engineer, for the Valier Coal Co., Chicago, and installed at Valier, Ill., shown in Fig. 6, is of interest in that it is a complete electrical installation using transmitted power furnished by the Central Illinois Public Service Co. which operates an extensive interconnected system. The incoming power

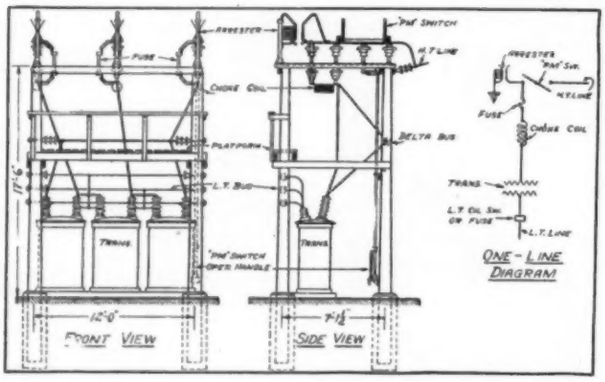

Fig. 5.—Typical Single Circuit Outdoor Substation with Large Capacity Transformers at Ground Level.

line is dead-ended to the steel tower, and by means of an overhead bus, taps are made to the arrester and load circuits. Three choke coils are so located that they offer a barrier to incoming lightning disturbances reflecting abnormal potentials to the arrester where they can be discharged. In the arrester circuit is a three-pole remote-control disconnecting switch operated by means of a handle at ground level. Below the choke coils is installed a three-pole disconnecting switch of the same type used in the lightning arrester circuit. Below this switch are three single-pole fuse mountings with fuses so rated that they will not blow except in case of transformer failure. The 33,000-volt primary metering equipment is located below the fuses, the current and potential transformers together with the watthour meter and demand indicator being a self-contained unit.

Just back of the main switching tower is located a second steel structure affording space for three 667-kv-a. 33,000/2300-volt, 60 cycle, single-phase transformers connected in closed delta. Above the transformers are the high-tension buses with their supports. The 2300-volt circuit is carried into the building by means of lead-covered cables and connected to a five-panel switchboard.

Panel 1 is equipped with a 2300-volt check meter and an automatic main oil circuit breaker. From this panel extends a 2300-volt bus located back of the other panels permitting connections to the various loads. Panel 2 controls the main underground feeder; panel 3 controls the 1350-hp. main hoist motor; panel 4 controls a 250-hp. air-shaft motor; and panel 5 controls the machine-shop and yard-lighting line. Each panel is equipped with automatic oil switches and the necessary instruments.

The underground cable from panel 2 terminates at a panel on which is mounted two automatic oil switches. The cable from one switch has a tap line to which is connected twenty underground substations, each station being equipped with three 25-kv-a. transformers and an oil switch. The feeder voltage of 2300 is transformed to 220 for use with alternating-current coal-cutting machines. On the same feeder cable is connected a 300-kw. 2300/220-volt motor-generator set supplying direct current for the main haulage trolley. This motor-generator set also supplies current to twelve stations for charging the storage battery locomotives. The other switch and cable supplies power to a 100-kw. 2300/220-volt motor-generator set for the main haulage direct-current trolley and also connects to twenty underground substations for supplying 220-volt alternating current to the coal-cutting machines.

The 75-kw. underground substations are at more or less temporary locations so that equipment can be moved as the work progresses, thus avoiding long secondary runs and giving full voltage to the motors. Control of the 1350 hp. hoist motor will be secured from the underground substation located near the base of the shaft. The operator, by means of switches and indicating devices, has positive control of and always knows the exact position of the hoist. During March, 25,000 tons of coal were mined at a power cost of approximately 6.5 cts. per ton, the load-factor on the station being 41.5%. During this month, power was also used for construction work in progress so that the total cost of power for coal mined was 8.1 cts. per ton. When the mine is in full operation and construction completed, the cost per ton will probably approximate 4 cts. or less.

66,000 Volt Substations.

The tendency toward higher transmission voltages has developed a need for 66,000-volt outdoor substations.

A feature of this type is in the use of three transformers in closed delta on one side of the station and a spare transformer at the opposite side. In case one transformer fails the spare can by means of disconnecting switches be immediately placed in service and in the correct electrical relation to the other transformers.

The high-tension side is controlled by means of a three-pole air-break switch operated from ground

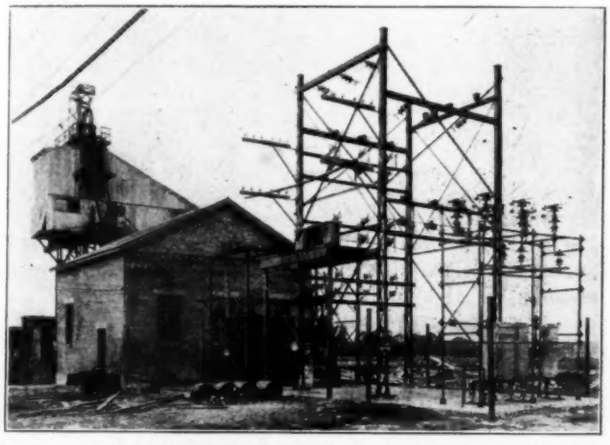

Fig. 6.—Scholz Substation at Valier, Ill. Supplied From Central Illinois Public Service Co.'s Lines.

level. On the switch bases are also mounted choke coils and fuses for the load circuit.

The lightning arresters are of the high speed sphere gap graded resistance type with auxiliary gaps shunted with limit fuses. In case of excessive flow of current to ground the limit fuses will operate in the usual manner. The arrester, however, is still connected to the line across the small auxiliary gap. This arrangement eliminates the possibility of entirely disconnecting the arresters after operation of the limit fuses.

Central-Station Rates in Theory and Practice

Fourteenth Article—Rate Systems and Reasons Therefor—Class Schedules Commonly Used—Minimum and Maximum Charges, Discounts and Related Features — Principal Types of Rates

By H. E. EISENMENGER

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This is the fourteenth article of this series, which began in the issue of July 12. The first seven articles, constituting Part I, dealt with the cost of electric service. Part II consisted of six articles on the general policy governing selection of a rate system from the standpoint of profit contributed by the several classes of customers. Part III begins this week and will consist of six articles on rate systems. The remaining parts of this series will deal with rate analysis, accuracy of rates, utility regulation and other topics closely related to rates. These articles will continue weekly until the last issue of the volume, Dec. 27.

PART III—SYSTEMS OF CHARGING.

1. General Features.

A. Reasons for Making Different Rates for Different Classes of Consumers.

NOTE: The examples given in Part III for the various types of rates have been taken from the author's collection of rate schedules and from other sources of information. Pains have been taken to get reliable figures and the given figures are believed to be correct, although some of them may have become obsolete and others may be erroneous in other respects. The author assumes no responsibility for their absolute correctness. His object is to illustrate the type of rate to the reader more quickly and vividly by definite figures than is possible by mere abstract descriptions. It is of very little importance whether the figures are absolutely correct and up-to-date and whether they apply in this one or some other city. These articles discuss principles and are *not* intended as a book of reference for the actual rate schedules now used in the different cities.

103. It has been demonstrated in Parts I and II that not only the unit amount of the classified expenses (energy cost, demand cost and customer cost) varies between different classes of customers, but that also the percentage of the profit from different classes should vary between these classes. The rates—that means the prices—to different classes of consumers will therefore have to be different for these two reasons.[1]

Price is the cost plus profit. If the cost is figured according to the three items of energy cost, demand cost and customer cost, it seems logical that the price should be figured in the same way. But in the case of rates we have to deal with the general public and it is the opinion of most central-station managers that this method is too complicated for the public to understand, especially for the small consumer. The less the average consumer understands about the system of charging, the more prone he will be to assume that the whole rate schedule is nothing but a device made expressly to cheat him out of his money. In case of larger customers we may expect that the electric light company has to deal with somebody who has sufficient arithmetical training to understand a proper explanation of the rates, even if they embody the three-charge system.

The rates to different classes of customers will therefore vary not only in the amounts they charge, but also in the form. We will consequently have generally a number of different rate schedules, each one applying for a different class of service.

B. Classification of Consumers for Rate Purposes in Practice.

104. These classes of service are not standardized among the various central stations, but a selection from the following list is generally found in the rate schedules of most central stations:

1. *General Lighting* or sometimes *General Light and Power.*
2. *Residence Lighting.*
3. *Commercial Lighting,* which means lighting of business localities.
4. *Display Lighting* (signs, windows, decorative lighting).
5. *Street Lighting.*
6. *General Power.*
7. *Wholesale Power* (incidental lighting sometimes included).
8. *Retail Power.*
9. *Ice Making,* also called *Refrigerating Service.*
10. *Heating and Cooking.*
11. *Primary* or *High-Tension Service.* The current is delivered at the central station's primary voltage and transformed by the customer in his own transformers. This is practicable only for very large customers. This schedule may also be expressed by a deduction under the heading of transformer rentals, if the consumer does not use the company's stepdown transformers.[2]
12. *Off-Peak Service.* Under this schedule the customer agrees not to use his current during certain specified hours, generally the evening hours of the

[1] This refers to the unit charges (energy charge, demand charge and customer charge). If we reduce the customer's total payment to the kilowatt-hour consumed, as is frequently done, we get of course much wider fluctuations of the price (average price per kilowatt-hour) between different customers (see Section 13).

[2] Sioux City Gas & Electric Co.

generator set supplying direct current for the main

winter months.[3] Sometimes the customer is allowed to use current under this schedule during the night hours only.[4]

13. *Auxiliary, Emergency* and *Breakdown Service.* For isolated plants in case of an increase of their demand over their capacity or in case of a breakdown of the isolated plant, in which case the installation is connected to the central-station service and its own generators through a double-throw switch.

14. *Battery Charging* for electric vehicles. Sometimes subdivided into "Wholesale" for public garages and "Retail" for private garages.

It is impossible to give a complete enumeration of all the varieties of schedules. Sometimes optional schedules appear under the same heading, so that the customer may choose which one of the two or more he considers preferable (see Section 106). The names of the schedules are, of course, not always the same as given above. Sometimes combinations of the above classes of schedules are found.[5]

105. A classification of the customers for rate purposes into these 14 classes, or into some of them, is carried out in every single large and medium-sized central station, and probably in every small one as well. Although these classes are by no means the only ones possible, other classes of rather isolated occurrence are found only in one or a few electric light companies.

C. Optional Rates.

106. Sometimes we find different types of rates, generally two in number, for the same class of customers in such a manner that the customer is allowed an option. One of the two rate schedules may, for instance, be of greater advantage to the customers with an energy consumption below a certain number of kilowatt-hours or with a demand below a certain amount or a combination of both. The other rate is then more favorable for the other customers (see first footnote of Section 108).

D. Minimum Charges and Guaranteed Minima.

107. Sometimes a rate schedule requires certain minimum guarantees from the customer, for instance a guarantee that his consumption during every month or every year will be large enough to bring his bill to a certain minimum amount either per month or per year.[6]

A minimum charge with the object of insuring a revenue of at least the "customer cost" from every customer is made in the vast majority of schedules which apply to residence lighting.[7] The minimum charge in that case ranges from 25 cents per month[8] to $1 net.[9]

The opinion of rate experts on the advisability of a minimum charge for residences seems to be strongly in favor of making such a charge, but it is not unanimous. A few of the large central stations in this country (among them New York, Chicago and Cleveland) prefer the gain in simplicity of the rate and the relatively slight risk that some of the customers now and then may pay less than a few dimes to the alternative risk of keeping prospective profitable customers away who are afraid to tie themselves down to a minimum.

These and similar questions in rate making are a matter of local conditions as well as of personal judgment and taste for which no hard and fast rules can be laid down. It is not easy to decide these questions and we have no means of saying, even afterwards, whether the decision was the best one or not. Rate making altogether is a matter of feeling and intuition as well as of exact research. Psychology, business instinct and experience have their place in the design of rates as well as engineering and mathematics. Many of the rate questions have to be decided temperamentally or artistically, if you please, rather than strictly scientifically.

108. An entirely different class from the minimum charges in residence schedules and other small-customer schedules is the minimum charge in schedules destined for large customers. The object here is to keep the small customers away from that schedule by requiring a rather large minimum payment per month or per year. In that case we have optional schedules, one with a high minimum charge and low unit rates per kilowatt-hour (or per kilowatt of demand or both) and the other schedule with a low minimum charge (or none at all) and a comparatively high unit rate per kilowatt-hour (or per kilowatt or both).[10]

Whereas the first kind of minimum charge is gen-

[3] In Allentown, Pa., for instance, current under the off-peak schedule is not available from 4 to 8 p. m. between Nov. 1 and Feb. 29. In St. Louis the peak hours assumed for the off-peak service are the following:

5:30 to 7:00 p. m. in October;
4:30 to 7:00 p. m. in November and December;
4:40 to 7:00 p. m. in January;
5:20 to 7:00 p. m. in February;
6:00 to 7:00 p. m. in March.

In Chicago an off-peak rate is available where the customer agrees during the peak period not to use more than 10% of the highest demand in the preceding year's peak period. The off-peak period in this case is counted between 4:00 and 8:30 p. m. from November to January and begins half an hour later in February.

Various methods are used to make the customer meet his obligations for the peak-loak period. A recording demand measuring instrument is installed as described in Insert XVI (for instance in Chicago) or a recording ammeter (Superior, Wis.). Where the off-peak schedule prohibits the customer from using any current at all during the peak period an automatic time switch in connection with a clock may be used (Spokane and St. Louis). Portland, Me., uses the expedient of stipulating that not more than 10% of the total power used annually shall be consumed between Nov. 1 and March 1 by consumers under the off-peak schedule. The "Ventilating Service" schedule at St. Louis, which is in effect an off-peak schedule, charges less for the service between April 15 and Oct. 15 than for the rest of the year. See also Section 111 about "Differential Rates."

[4] "Night Service" in St. Louis 10 p. m. to 7 a. m. and Spokane 7 to 7; "Night Power" in Hartford, Conn., 10 to 7, and Altoona, Pa., 11 to 6.

[5] Thus, for instance, in Topeka, Kans., under the "Battery-Charging Rate" customers must agree not to use current for that purpose between 4:30 and 8:30 p. m., so that the rate can be classed also as an off-peak rate. Another combination is, for instance, the "Primary Off-Peak Rate" in Detroit.

[6] This is not quite the same. For instance, a guarantee of $1200 per year is not entirely equivalent to one of $100 per month. The first guarantee would be fulfilled by a customer who is paying $150 during each one of the six winter months and $50 during each one of the six summer months, whereas under the second named plan that customer would be required to pay an additional $50 for every one of the summer months. The first plan requires a little more work on the part of the central station, since the bills of customers near the limit must be added up at the end of the year, whereas the other plan takes care of itself month by month. These considerations have led in a few cases to a stipulation of a monthly *and* a yearly minimum. The wholesale power schedule of Allentown, Pa., for instance, requires a minimum charge of 50 cents per horsepower connected and the twelve bills in a year must moreover amount to at least $15 per horsepower.

[7] This refers to central stations in cities of medium and large size. No information for statistical purposes is obtainable from the innumerable central stations in smaller towns, but we have no reason to assume that their rates should be essentially different from those in the larger cities.

[8] Duluth and New Orleans.

[9] The favorite amounts for the minimum charge in that case are 50 cents and $1; other values are of rare occurrence. In about a dozen cases we find yearly minimum charges in schedules which apply to residences. The most important of these cases are Baltimore, Boston, Brooklyn and Buffalo. In Pueblo, Colo., the residence lighting minimum charge is 3½ cents *per day!* St. Joseph, Mo., makes a higher minimum charge for residences in rural districts (75 instead of 50 cents), thus expressing the distance factor by the minimum charge. (A few central stations have entirely different rates for outlying districts.) Salem, Mass., increases the minimum charge from 50 cents to 75 cents for summer residences. The minimum charge of the Display Lighting schedule in Sacramento, Cal., varies with the season and is only about 57% in June of what it is in December. The General Lighting schedule of York, Pa., charges $1 minimum per month in winter and 50 cents in summer.

erally not more than $1 per month, the minimum charge or guarantee of the second type, that is, with the object of reserving a certain schedule for the large consumers, is naturally rather high and we find figures as high as $3000 per year (Primary Service, Indianapolis) or even $340 per month (Primary Large Lighting and Power, Chicago).

So far in this discussion the minimum charge has always been understood as a guarantee on the part of the customer to pay a certain amount in dollars and cents every month or year. This is the most frequent case. Not infrequently, however, we find a stipulation in a rate schedule requiring the customer to pay for a certain minimum number of kilowatt-hours or for a certain minimum of demand in kilowatts, watts, horsepower, or whatever the unit for the demand may be.

[10] For instance, in Toledo, Ohio, public garages can get battery-charging current at 5 cents per kw-hr. (net) with a minimum charge of $3 per month (this rate to be called Rate A hereinafter for short), but if they guarantee a minimum bill of $50 per month they get their current at 2 cents per kw-hr. (Rate B).

A graphical and analytical investigation of what this means may prove instructive. We step off as abscissae (horizontally) the energy consumption in kilowatt-hours (Fig. 4) and as ordinates (vertically) the amount of the bill in dollars per month. Beginning with Rate B we find that at 2 cents per kw-hr. the customer is to pay $20 for 1000 kw-hr. (point b_1), $40 for 2000 (point b_2), $60 for 3000, etc. The curve representing the bill as a function of the energy consumption will obviously be a straight line OB starting from the origin O. There is, however, a minimum of $50 for the bill. This minimum is denoted by the horizontal line NN'. The portion of the inclined line OB which is situated below horizontal NN' does not apply and NN' applies instead. Rate B is thus represented by the heavy dash-and-dot duct from N over P to B. On the other hand, we have the optional rate A of 5 cents per kw-hr. with a $3 minimum. We get the straight line OA and here again a minimum charge applies. This is now $3 and is represented by the horizontal line MM'. Rate A is represented by the heavy outlined duct from M over K to A. As the customer has the desire to get the lowest bill possible he will pick out that one of the two rates which shows the lower bill for his particular energy consumption; in other words, the rate represented by the duct which is lower for that respective energy consumption. The bill of the customers who choose their schedule wisely is then given by the ordinates of the shaded area. Small customers will be better off on Rate A, large ones under Rate B.

Where is the limit between those two sizes of customers, in other words, up to what energy consumption is it more advantageous for a customers to use Rate A? This limit is evidently given by the point L where the line duct ("curve") of Rate A intersects that of Rate B. The intersection means that the bill is the same for the respective energy consumption, whether the customer is being charged under Rate A or Rate B. This intersection is given by point L in Fig. 4 and the energy consumption belonging to that point will give the limiting value. We can

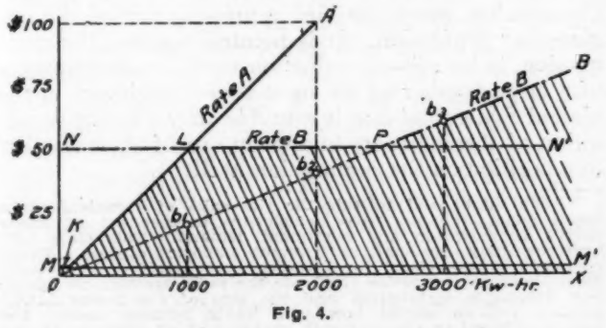


Fig. 4.

either find that value in kilowatt-hours by measuring it in the drawing with the kilowatt-hour scale or we can figure it in the following way:

The ordinate of L is $50 because L lies on the minimum-charge line NN'. On the other hand, the unknown amount of energy multiplied by 5 cents per kw-hr. must give $50. It is easy to figure out that 1000 kw-hr. are necessary to make up a charge of $50 at the rate of 5 cents per kw-hr. All customers with less than 1000 kw-hr. energy consumption should choose Rate A, the others Rate B.

The graph Fig. 4 also shows that all customers using Rate B between the points L and P are charged the identical amount of $50. Point P can easily be found as corresponding to $\frac{\$50}{2 \text{ cents per kw-hr.}} = \frac{5000 \text{ cents}}{2 \text{ cents per kw-hr.}} = 2500$ kw-hr. Therefore, all customers using between 1000 and 2500 kw-hr. per month and choosing the schedule which is of best advantage for them will have to pay uniformly $50 no matter how large their energy consumption was within these limits.

We find further that the minimum charge of $3 (Rate A) affects the 5-cent-per-kw-hr. rate for such customers only as have a kilowatt-hour consumption of less than $300/5 = 60$ kw-hr. per month (point K).

This is not quite the same as guaranteeing a minimum bill (except in case of the simplest rates), as will be shown later (Section 168), but the object is the same.

E. Maximum Unit Charges.

109. In some cases we find a clause in the rate schedules to the effect that where the average charge per kilowatt-hour figures out higher than a certain specified maximum the bill shall not be higher than what corresponds to that maximum average amount in cents per kilowatt-hour, regardless of what the schedule says elsewhere. This is in a certain measure the reverse of the minimum charge discussed in the preceding sections. Here, as well as with the minimum charges (see first footnote to Section 107) this restriction may apply either to the individual monthly bill or to the sum of the 12 monthly bills rendered during the year. For examples and further discussion of this principle of the maximum unit charge (which is not frequently applied) see Section 124, first and third footnotes.

F. Prompt-Payment Discounts and Delayed-Payment Penalties.

110. A prompt-payment discount, to induce the customers towards early settlement of their bills can be found in about three of every four rate schedules of the more important central-station companies in this country. The time within which this discount is allowed is 10 days in the great majority of cases, and the percentage taken off is usually either 10% or 5%. Sometimes the discount is expressed in terms of cents per kilowatt-hour, generally 1 cent or 0.5 cent per kw-hr. In a few cases the discount is limited, for instance the discount is given only on the first 200 kw-hr.[11] In some cases the gross unit charge is an odd figure which becomes a round figure after the deduction of the discount.[12]

Of course, most of the customers avail themselves of the prompt-payment discount and this makes the rate look higher on paper than what is actually being paid. If, for instance, we have a 10-cent-per-kw-hr. rate with a prompt-payment discount of 1 cent per kw-hr., the rate which almost everybody is actually paying will be 9 cents per kw-hr. and yet almost everybody will say: "We have a 10-cent rate." The company will get the blame for a higher rate than it actually charges. For this reason a few companies have reversed the statement by introducing a delayed-payment penalty. This would mean in the example quoted above: 9 cents per kw-hr. with a delayed payment penalty of 1 cent per kw-hr. It amounts to the same, only it sounds better and the impression given is more correct.[13] In one case[14] an aditional stipulation is made that the minimum amount of the delayed-payment penalty is 25 cents. The idea of this is evidently that as soon as a customer gets on the delinquent list he causes the company a certain amount of clerical work and other expenses, no matter how large or how small the amount of his bill is. We see here again the principle of the minimum charge.

[11] Lighting and Power schedule, Indianapolis, Ind.

[12] For instance, the cooking rate in Toledo, Ohio, is a straight-line meter rate of 5.56 cents per kw-hr. with 10% discount if the bill is paid within 10 days, thus making the net rate practically 5 cents per kw-hr.

[13] Delayed-payment penalties can be found in the rates of Philadelphia, Cincinnati, Washington, D. C., and a few other cities. In New Orleans, where two electric light companies are operating, one of the two charges a 7-cent rate with a 10-day delayed penalty of 1 cent for general lighting, whereas the other one charges an 8-cent rate with a 10-day prompt-payment discount of 1 cent.

[14] Topeka, Kans.

II. The Various Types of Rates.

A. Introduction.

111. The various types of rates base the amount of the bill of a certain consumer on his energy consumption or on his maximum demand or on both.

There are a very few exceptions to this rule, but under certain unconstrained assumptions we can bring even these under the above rule.

In the first place we find some isolated cases of rates which make the amount payable dependent also on the amount which the customer has been willing to guarantee in advance as a minimum payment per month.[1]

Evidently there will exist a certain guarantee for every customer which makes his bill smaller than any other guarantee would. If he guarantees less than that amount he will have to pay an unnecessarily high unit price and if he guarantees more his guarantee is higher than what he actually consumes. It is clear that, provided the consumer chooses his guarantee wisely, he will find his bill dependent only on the energy consumption and the demand, in other words, under that assumption there will be only one amount of the bill possible for every conceivable combination of kilowatt-hours consumption and kilowatts demand.

Another exception to the above rule, that the price charged to the customer under a certain schedule depends only on the amount of the kilowatts used and kilowatt-hours consumed by him, is the so-called time-differential rate which, however, though extensively in use in European countries, is hardly used in this country. Almost the only instance the author could find of this rate in this country is the "Time-Differential Service" rate in Detroit for auxiliary and emergency service for private plants. Ten cents per kw-hr. are charged for all energy consumed between 1:00 p. m. and 6:30 p. m. and 4 cents per kw-hr. at all other hours. This really is nothing but a combination with an off-peak schedule (cf. Section 104, footnote). If we consider the high-rate hours and the low-rate hours separately, we have again reduced the amount payable to the original elements of kilowatts and kilowatt-hours in each one of the two daily periods.

If, therefore, in this manner all rates can be assumed to be based upon the two elements of kilowatt-hour consumption and kilowatt demand only, we can distinguish the following three classes of rates:

(1) Rates based on the energy consumption only.
(2) Rates based on the maximum demand only.
(3) Rates based on both energy consumption and maximum demand.[2]

B. Rates Based on the Energy Consumption Only.

1. *The Straight Meter Rate.*

112. The straight meter rate is one of the simplest and one of the oldest systems of charging, but by no means one of the most satisfactory ones, at least not for general use. The customer's bill is proportional to the number of kilowatt-hours used, as measured by a watt-hour meter.[3] Frequently the straight meter rate is combined with a minimum charge[4] or sometimes with a customer charge.[5] The advantages of the straight meter rate are its simplicity and the readiness with which it is understood by the public.

113. A variety of the straight meter rate is the *prepayment-meter rate* for very small customers. A prepayment meter is a watt-hour meter constructed in combination with a vending machine ("penny-in-the-slot" machine). The customer inserts a coin of certain specified value, for instance a quarter, into the slot of the prepayment meter and then is furnished with current until he has consumed the amount of energy for which he has paid by that sum. After that time his circuit is automatically opened by the mechanism of the prepayment meter and his lights go out, usually after a warning of some kind has been given to him.

Opinions on the merits of the prepayment meter, as on so many other rate questions, are divided. The idea of paying in small amounts in preference to paying comparatively larger sums at the end of the month certainly appeals to some classes of the poorer population and is based on sound psychology. Meter readings are unnecessary and bad debts are avoided. On the other hand, the meter is more expensive and complicated than an ordinary watt-hour meter and gives more occasion for complaints. The extinguishing of the lamps at inopportune times is a great annoyance, especially if there is no coin of the required denomination at hand.[6]

(To be continued.)

[1] An example is the Retail Lighting and Power schedule of Pittsburgh, which charges the following average prices per kw-hr.:

Cents per kw-hr.	If maximum demand is	And guarantee is
10	1	$ 1.00
9	1	3.00
8	1	5.00
6.5	1	10.00
5.5	1	15.00
5	1	20.00
4.25	1	25.00
3.75	2	36.00
3.25	3	52.00
2.75	5	79.00
2.25	8	107.00

Add $1.00 to guarantee for each additional kw. of demand. Another example is the Toledo Battery-Charging rate, which is quoted and discussed in footnote 10 of Section 108.

[2] We might add to this for the sake of completeness a fourth class, that is, rates which are independent of either energy consumption and maximum demand. This class has, however, only academic and slight historic interest. Every customer of the class, for instance every residence customer, would have to pay under that rate the same amount, no matter how large his installation and the size of the lamps in his sockets and no matter how long he is burning them. The rate is reduced to the customer charge and all other costs, but the customer cost, are averaged into the customer charge, the assumption being that the difference in cost between residence customers is not very large and that we can simply charge the average cost for every customer plus a percentage of profit. Such rates have been in use in a very few cases during the earliest days of central-station history. If the author's information is correct, one instance was in Monticello, N. Y. This type of rate has been abandoned long ago. (See later Part V—"Accuracy of Rates").

[3] An example of a straight meter rate is the Residence Lighting rate of the Bronx Gas & Electric Co., of New York, where the customer is simply charged 12 cents per kilowatt-hour.

[4] For instance, in the General Lighting and Power schedule of Boston, which charges 8.5 cents for every kilowatt-hour consumed, but with a minimum charge of $9 per year, payable monthly.

[5] Battery-Charging schedule of Springfield, Ohio, which makes a customer charge of $1.50 and an energy charge of 3 cents per kw-hr.

[6] About another rate especially adopted for the smallest customers, the limited flat demand rate, see Sections 128-130.

ENGINEER TO BE SUGGESTED FOR INTERSTATE COMMERCE COMMISSION.

The American Association of Engineers, through its president, Dr. F. H. Newell, University of Illinois, is petitioning President Wilson to select as his next appointee to membership in the Interstate Commerce Commission, some qualified representative of the engineering profession. It is pointed out that the commission, in its railway valuation work, is the employer of a large number of the most skilled engineers in the United States, and that it would be only a fitting recognition of the engineers to appoint one of their number to a position on the commission itself.

Tests to Determine Deterioration of Small Dry Cells with Age

Explanation of Terms—Outline of Test Methods—Results Obtained — Abstract of Paper Before American Electrochemical Society

By A. J. HELFRECHT

IT IS well known that small dry cells undergo a steady depreciation in capacity from the time they are made, and a knowledge of the rate at which such depreciation takes place has become of great technical importance due the extensive use to which dry cells are being put, and because of the new and exacting demands which are being placed upon this type of cell in its application to wireless telegraphy and telephony.

The term "shelf deterioration" is employed to designate the decrease in capacity which a dry cell undergoes when not in use. This factor has been touched upon in various papers presented to this society, and it is the purpose of this paper to present further data on this subject dealing specifically with the smaller sizes of cells.

The actual determination of the capacity of a dry cell involves its discharge and, therefore, its destruction; hence, to determine the rate of deterioration over a period of time by this method, tests must be made upon a sufficiently large number of cells of identical construction to give the required information. To avoid the complication and expense involved by such method, there is need of a deterioration test which can be made on a single cell without its destruction by the testing method. But no such test has been evolved which gives more than a crude approximation. It is a common but a decidedly misleading practice of numerous battery makers to guarantee their product not to deteriorate more than a specified percentage over a given period of time as judged by the decrease in voltage. The absurdity of this method is shown by the fact that the open circuit voltage of a cell has little relationship to its watt-hour capacity. A cell may decrease 50% in actual capacity, while its open circuit voltage may decrease not more than 10%. A more rational, but still unsatisfactory method which has had some use is to judge the deterioration of a cell by measuring its "flash" or its instantaneous short-circuit current at various intervals. It is known that as a cell deteriorates with age its internal resistance increases and consequently its flash decreases.

The main purpose of this paper is to present results showing how closely this method of judging cell deterioration approaches the method involving the actual measurement of capacity through discharging the cells.

Cells of four different sizes representing the range of the flash light cells on the market were employed in this test. Part of these were purchased on the open market of a standard well-known make, and to eliminate the factor of uncertainty as to the time which elapsed from the date of manufacture to the date of purchase, many other cells of these same sizes were made up in our laboratories by trained workmen, using standard materials, such as are used in the regular marketed product, special care being taken to avoid variations in construction between the different cells.

In the absence of uniform testing methods adopted by manufacturers, in the investigation covered by this paper the "flash" tests were made by short-circuiting each cell through a low-resistance Weston ammeter for as short a period as would indicate the steady maximum deflection of the needle. This test was repeated periodically over a year's time to indicate the deterioration. Since the initial flash differs greatly between individual cells of one make, the decrease of flash as time passes is expressed not in terms of decrease in amperes but in percentage of the initial flash when the cells are first put on test. This method places the readings as between different batteries on a more common basis.

Capacity tests were made by a method described in detail in "Characteristics of Small Dry Cells," by C. F. Burgess,* and designated here as the "4 ohm" test, in which each cell is connected to a 4-ohm coil and discharged 8 hours per day until the closed circuit voltage drops to 0.5 volt.

The corresponding test recommended by the Bureau of Standards consists in the use of a 2.75-ohm coil and discharging to a similar end point of 0.5 volt.

The "4 ohm" test used for the investigation set forth in this paper was adopted prior to the publica-

*Trans. Am. Electrochem. Soc. (1916), 30, 257.

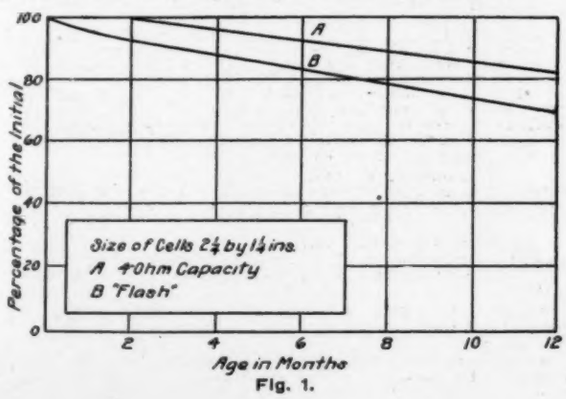


Fig. 1.

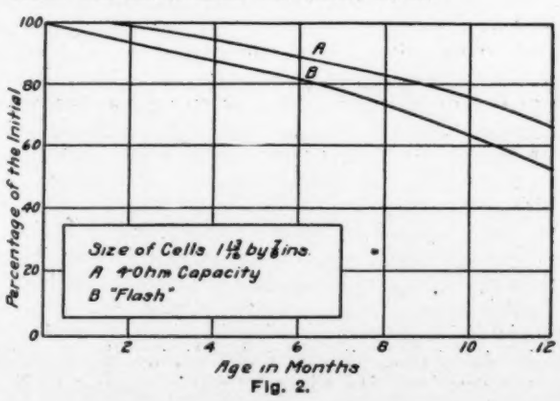
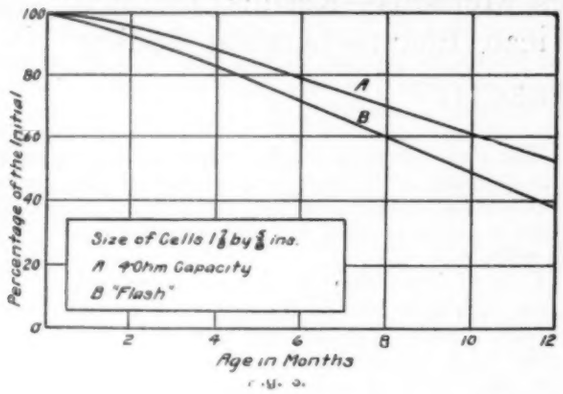


Fig. 2.

tion of the bulletin of the Bureau of Standards and to draw a comparison between these two tests a special lot of cells was made up and tested by the two methods.

RESULTS.

In comparing the "4 ohm" test for capacity with the "2.75 ohm" test and expressed in time of service



until the cells reached the 0.5 volts end point, the average of numerous measurements showed that the time of service on the latter test is 60% of that of the former with a range between 55% and 65%. In the accompanying curves, Fig. 1 shows the depreciation of the most largely used size of flashlight cell, such as is employed in tubular handlamps, 1½ ins. diameter and 2¼ ins. high. Graph *A* shows the percentage decrease in capacity during a period of one year as determined by the "4 ohm" test. There is no appreciable depreciation in capacity during the first two months, and during the remaining 10 months the depreciation of about 17% follows approximately a straight line. The corresponding graph *B*, derived by the "flash" test indicates an almost linear depreciation from the beginning of the test. The notable deduction from this curve sheet, as well as from the others which follow, is that the depreciation indicated by the "flash" test is decidedly greater than that measured by the actual capacity.

Curves Nos. 2, 3 and 4 represent in a similar way tests on smaller sizes of cells and indicate clearly the variations in performance as the cells decrease in size.

The curves as a whole show that the actual depreciation as measured by the capacity tests is less than the apparent depreciation determined by the flash tests and this departure becomes especially marked in the smallest size of cell. This difference is due to the fact that the "flash" test is influenced mainly by the internal resistance of the cell which slowly increases with age. Since this internal resistance is but small as compared with the resistance through which the cells deliver current when working normally or when placed on capacity test, the increased internal resistance does not necessarily influence to a large degree the ability of the cell to deliver current as measured in ampere hours. This must not be taken as an argument against the use of the "flash" test to indicate depreciation since the great simplicity and convenience of this test amply justifies its use. Where it is used, however, it should be borne in mind that it indicates a more rapid falling off in capacity than is actually the case, and the injustice which may thereby be done to the cell is especially great in the smallest sizes.

It is of interest to note that in Figs. 1, 2 and 3 the graphs *A* and *B* are divergent at their lower ends, while for the smallest size of cell (Fig. 4), the two lines converge. This is explainable by the fact that as the flash becomes zero the capacity must also approach zero, and in Figs. 1, 2 and 3 this convergence would be noted if the tests were carried further.

Previous discussions held before this have shown that any test on a dry cell will show the condition of a dry cell only at the time it is tested, without indicating what the condition of the cell will be at the same future date. While this is undoubtedly true, it is nevertheless true that shop and laboratory tests accompanying uniform methods of manufacture may furnish the means of foretelling with reasonable accuracy the future performance of a dry cell.

While the "4-ohm" test as used in this report cannot be considered as a standard method in view of the recommendations of the Bureau of Standards for a "2.75-ohm" test, nevertheless the curves here presented may be taken as representing fairly well the true relationship between the "flash" and the "capacity" tests. This statement is based upon a "2.75-ohm" test being made on a number of cells of various sizes and ages as a check against the "4-ohm" test.

It must also be borne in mind that either 2.75 ohms or 4 ohms per cell represents a much more rapid discharge than the small dry cells are frequently called upon to deliver in service. For example, in radio work, in which the cell shown in Fig. 3 is extensively employed, the actual current requirements are very low. A resistance of 333 ohms per cell has been adopted for testing batteries for such service. Extensive investigation has been made by one laboratory on batteries designed for this type of service, 15 cells being assembled in a battery delivering an initial voltage of 22.5 volts. In testing these batteries an end point of 17 volts is taken through a resistance of 5000 ohms. The results derived from such tests give curves of the same general shape as shown in curve No. 3. It may be noted, however, that on very slow discharges, the decrease in capacity is shown to be less during the early part of the life of the cell than is shown where the more rapid discharge method is employed.

While it is difficult to express numerically the depreciation which might be expected from dry cells as

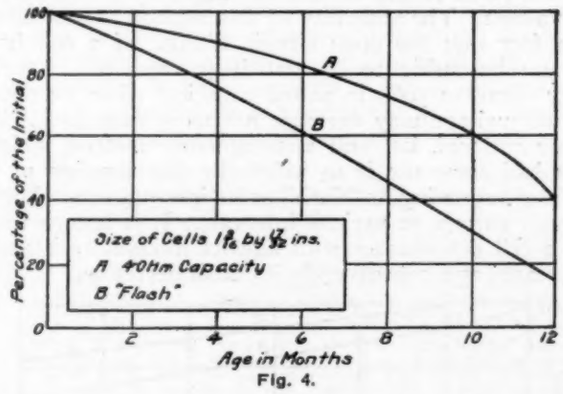


Fig. 4.

found on the market, nevertheless an approximation may be arrived at. From the data on which this paper is based, the following table has been compiled to indicate the reasonable depreciation of the four important sizes of small cells.

Size of Cells. Inches.	Centimeters.	Depreciation per Month, % First 2 Mo.	Last 10 Mo.
2¼ by 1¼	5.7 by 3.2	0.0	2.1
1 13/16 by ⅞	4.6 by 2.2	0.25	4.0
1⅛ by ⅝	4.8 by 1.6	2.0	5.5
1 9/16 by 17/32	4.0 by 1.4	2.0	6.5

Street Lighting and Traffic Accidents

Analysis of Year's Traffic Accidents in Cleveland as to Time of Day and Season Shows Large Percentage Due to Lack of Light — Value of Good Street Lighting Shown

By WARD HARRISON

Illuminating Engineer, National Lamp Works of General Electric Co.

AN exhaustive survey has been published* showing that improper or inadequate lighting is at least a contributing cause of 24% of our industrial accidents. There are, however, no definite data available which show how many of the traffic accidents on city streets are due to this cause. The following survey of 3549 traffic accidents, shown on the records of the Police Department of the city of Cleveland, for a period of one year will therefore be of some interest.

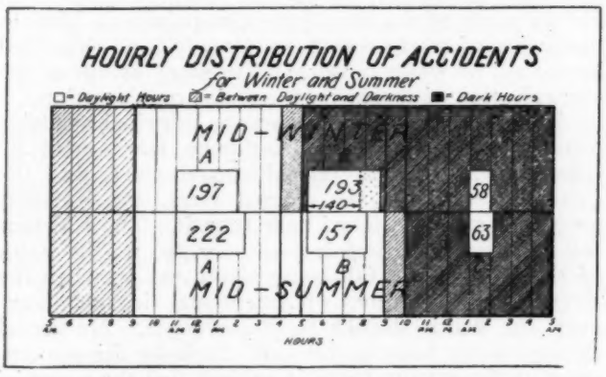


Fig. 1.—Graphic Study of Street Traffic Accidents in Cleveland as Compared to Hours of Daylight and Darkness in Summer and Winter.

The purpose of this survey was to determine, if possible, how many of the 1059 accidents which occurred after dark would have been avoided had daylight or its equivalent been available. The simplest way of making such an estimate would be to compare the accidents which occur between, say, 5 and 9 p. m. in mid-summer when daylight is available with the number for the corresponding hours in mid-winter when it is dark. The records actually show that there were 157 accidents between these hours in June and July, while for December and January the total was 193, or about 22% more.

There are, however, several other variables beside the question of daylight and darkness which one must take into consideration when comparing accidents in winter with those in summer. For example, there are as a rule very many less vehicles on the streets in mid-winter, hence less liability of accident; on the other hand, this factor is counterbalanced to some extent by the effect of slippery pavements. It is necessary therefore to separate out these other variables before we can decide upon just how many of the 193 accidents on mid-winter evenings should be attributed to lack of light. Obviously, we can find the relative effect of all these other factors, except lighting, by comparing the number of accidents which occur during the middle of the day in winter months with those in the summer months or, for that matter, those that occur in the middle of the night at both seasons of the year. On this point the records show for December and January 12½% less accidents between 9 a. m. and 4 p. m. than occurred during the same hours for June and July, and they also show 8½% less accidents for the winter months during the hours that were dark at both seasons, viz., from 10 p. m. to 5 a. m. We are justified therefore in stating that, except for the question of light, there would really have been fewer accidents between 5 and 9 p. m. in the winter months than for the corresponding summer months. To be exact, instead of 193 accidents in the winter for every 157 accidents in the summer, we would have found 140 accidents in the winter had it not been for the lack of daylight. In other words, there were 53 accidents which can be attributed directly to lack of light. If we apply the same proportion, viz., the ratio between 53 and 193 to the total number of accidents occurring after dark in Cleveland during the whole year, we find that 292 of them are to be attributed to lack of light, and of these at least 14 must be classed as fatal accidents.

It of course seems out of the question today to provide street lighting which is as effective in pre-

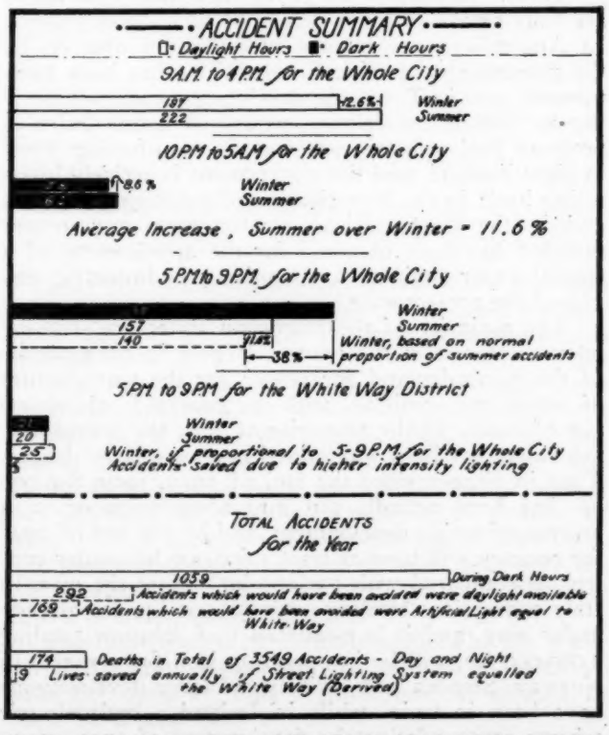


Fig. 2.—Comparison of Street Traffic Accidents at Corresponding Hours in Summer and Winter, Showing Influence of Darkness.

*"Illumination and One Year's Accidents," by R. E. Simpson, Travelers' Insurance Co. Transactions, Illuminating Engineering Society, Vol. X, No. 9 (1915).

venting accidents as daylight itself.' It is nevertheless interesting to contrast the difference in accidents in the White Way district of the city with the number occurring in other portions. In this case, however, the total number of accidents involved is so small that the figures can only be taken as indicative. In the White Way district there were 20 accidents in summer between 5 and 9 p. m., and 21 in winter; whereas, the proportion for the city as a whole for these hours would indicate 25 accidents in the winter to every 20 occurring in the summer. We are safe in saying, therefore, that the higher intensity lighting in the White Way district has a marked tendency to reduce accidents.

The charts included, Figs. 1 and 2, summarize graphically the information given above.

HYDROELECTRIC POWER DEVELOPMENT IN BRITISH EMPIRE.

Further Report by British Water-Power Committee on Status and Plans for Development in Colonies, Etc.

We give below a summary of the present position of hydroelectric power development work in different parts of the British Empire and some European countries, as brought out in the second report issued by the Water Power Committee of the Conjoint Board of Scientific Societies.

The British Government has appointed a committee to investigate the water-power resources of Great Britain and Ireland. In India two eminent engineers have been appointed by the Indian Government to investigate the more promising sites. In Ceylon the water-power question is being considered by a committee appointed by the Ceylon Government. In British Guiana the discovery of large deposits of bauxite has suggested a possible and immediate use for the enormous water powers which the colony possesses. In Canada the government and community are fully awake to the necessity of such developments. In Australia a preliminary investigation ordered by the government of New South Wales has been commenced, and in Tasmania developments are progressing as fast as conditions permit. A great desire to promote hydroelectric schemes is manifesting itself in New Zealand, and the government is actively interesting itself in the investigation of promising schemes and in the East African Protectorate, government sanction has been obtained for the appointment of a special water engineer to organize a hydrometric survey of the protectorate.

The majority of the European states are showing intense interest in the matter, largely in consequence of the great demand for power for the manufacture of munitions, combined with the general world shortage of coal. In the countries at war, the normal development has been accelerated in a very large degree. Thus in France since the end of 1915, some 850,000 hp. has been actually put into commission or is in process of active development, and by the end of 1921 the country will have at least 1,600,000 hp. under control, as compared with 750,000 hp. before the war. In Italy concessions totaling over 250,000 hp. are already under way, and it is estimated that schemes totaling 2,000,000 hp. will be in operation in a few years. In Norway, Sweden and Switzerland large developments have been in train, while in Iceland a hydroelectric scheme contemplating the development of over 1,000,000 hp. from the River Fjorsaavasdraget is planned by an Icelandic company. In Spain various large projects are under consideration, including one on the Douro which is estimated to be capable of giving some 350,000 hp. In Bavaria a large project has been initiated to be financed in part by the state, in part by the various towns interested, and in part by existing stations; the total cost of the scheme is about 78,000,000 marks. In Wurtemburg, Saxony, and Prussia the state is to participate in the development and administration of electricity works. In Austria some 433 falls, with an aggregate average yield of 1,500,000 kw., have been surveyed; of these 17 have been secured outright, while seven additional concessions are pending. The aggregate of these 24 schemes totals 135,000 kw. Other large hydroelectric schemes have been planned and include an installation of some 25,000 kw. on the Talebor river, and one of some 120,000 kw. on the Wallsee.

Some information is given briefly respecting the use of hydroelectric power for railway electrification in the United States and a good deal of attention is naturally devoted to developments in Canada. In France much of the line of the Compagnie du Midi in the region of the Pyrenees has already been electrified by the aid of water power, and in many countries the electrification of trunk lines is under consideration.

In regard to British Guiana the principal available water powers lie on the Essiquibo river, with its tributary the Potaro, the Mazuruni river, and the Cuyuin river. On the Potaro river, the Kaieteur gorge has a total drop of over 1000 ft. The Kaieteur fall itself has a vertical drop of over 740 ft., the width of the head of the fall being about 400 ft. when the river is full. In times of exceptional drought, however, the width shrinks to 50 or 60 ft. No actual measurements have as yet been made by the government of the colony, but it is evident that the potential water power of British Guiana is extremely large. Thus the Kaieteur alone at the fall and gorge, assuming a mean depth of 10 ft. over the fall, offers possibilities of 2.5 million hp. The power developable in periods of drought, assuming a width of 60 ft. and a mean depth of 5 ft., would be about 125,000 hp. As very extensive deposits of bauxite have been proved in British Guiana, the country would appear to be exceptionally well situated for becoming an important producer of aluminum for the empire.

Turning to Australia, it is shown that the chief electrical engineer of New South Wales estimates that 300,000 hp. is continuously available from 18 schemes already investigated or partially investigated. The chief powers are on the Snowy river, 137,400 hp., the Clarence, 100,000 hp., and the Tumut, Shoalhaven and Nymboida, each about 10,000 hp.

In Victoria the large scheme for utilizing the available water powers between the Kiewa and Snowy rivers is still under consideration. It is estimated that the scheme will give more than 100,000 hp. at an estimated total outlay on a pre-war basis of $4,390,000.

The Tasmanian Government hydroelectric department is continuing its policy of surveying, as opportunity permits, the more promising sites. At present the principal purchasers of power from the hydroelectric department are the Hobart Corporation for tramways and general municipal requirements, the Electrolytic Zinc Co., and the Hydroelectric Power & Metallurgical Co., Ltd., which has installed works for the manufacture of calcium carbide. The present capacity of these works is 5000 tons per annum, but it is proposed to increase this. It is estimated that the electrolytic zinc plant may eventually absorb up to 26,000 hp. There appears to be every prospect of a

ready demand for all the hydraulic power which can be developed by the department.

In Papua, or British New Guinea, taking all the rivers of any size, with their tributaries, in the central, northeastern, Kumusi, and Mambare divisions, it is estimated that the available horsepower would be somewhere in the vicinity of 6,000,000; and if the huge river systems in the gulf, delta and western divisions were included, 10,000,000 hp. would be well under the mark.

In addition, it is estimated that the occupied territory of German New Guinea affords possibilities of between 7,000,000 and 10,000,000 hp.

A great desire to promote hydroelectric schemes is manifesting itself in New Zealand. The success which has attended the hydroelectric works at Coleridge is apparently having considerable influence in favor of constructing other power schemes throughout the dominion. A scheme for the development of three important sites in the North Island has been prepared. From these it is proposed to develop 130,000 hp., requiring a plant capacity, in the main power stations, of 160,000 hp. The scheme is intended to render power available for every householder in the island and for any industry: also for main-line electrification, light railways and for coal and other mines. The sources mentioned are capable of supplying much more power than it is proposed to develop under the present scheme. Various new industries depending on the supply of electrical energy are either started or are proposed, and it seems clear that the government will be drawn into extensive hydroelectric development for the whole of the dominion.

In Rhodesia a gauging of the Zambesi at a point five miles above the Victoria Falls shows that the volume of water was 11,750 cu. ft. per second. It is estimated that the available fall is 315 ft., which would correspond to an output of about 350,000 hp.

In East Africa three projects, each of about 2000 hp., are being negotiated within 50 miles of Nairobi, and numerous smaller projects are being developed. In 1918 government sanction was accorded to the appointment of a special water engineer to organize and carry out, so far as funds may allow, a hydrographic survey of the protectorate.

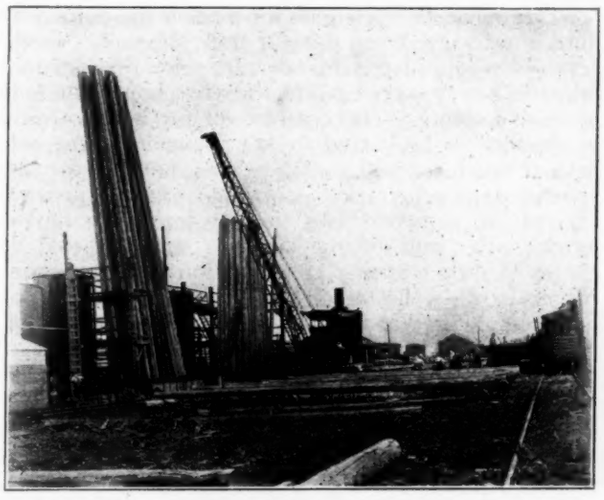
CONSERVATION ESSENTIAL IN CONSUMPTION OF WOODEN POLES.

Effective Preservative Treatment More Than Doubles Pole Life—Results in Conserving Supply and Reducing Maintenance Costs—Co-operative Treating Plant.

A preservative treatment for cedar and other classes of wooden poles used in carrying telephone, telegraph and electric power lines is fully recognized as essential in the conservation of our forest resources and of special importance in reducing maintenance charges in connection with such lines. The standing timber suitable for poles, existing in the northern, northwestern and southern states, is by no means limitless. In fact, it is estimated by competent authorities that the requirements for replacements and normal expansion will result in a practical exhaustion of such resources within 60 years, unless effective methods of conservation are extensively applied.

The erection of telephone and electric lines was very active in the central states and other sections 10 to 15 years ago, and on many of those lines practically very little consideration was given to any preservative treatment of the poles. As a result, the present demands for replacements due to decay are very heavy. Those replacements amount to hundreds of thousands of poles annually.

While the practice of treating the butts of poles is greatly increasing, it is estimated that at least 65 or 70% of the poles being required are erected without preservative treatment. The number of poles purchased in the United States in 1915 reached over 4,000,000, classified as follows: Western red cedar and northern white cedar, 2,314,980; southern white cedar, 89,244; chestnut, 651,643; cyprus, 67,644; pine, 546,233. Data supplied by the Forest Service show



Plant of Western Cedar Pole Preservers, Sand Point, Idaho, Showing Locomotive Crane in Service and Two Loads of Poles Receiving "B" Treatment.

that 95% of all poles are destroyed by decay, 4% by insects, and 1% by mechanical abrasion.

An estimate of the average life of poles of the several classes is as follows:

	Untreated, years.	Treated, "B" method, years.
Western red and northern white cedar.	16	30
Chestnut	12	16
Cyprus	6	15
Pine	6½	20*
Southern white cedar (juniper)	8	18

*Pressure method.

This estimate is regarded as conservative, especially with regard to poles of the western red and northern white cedars, for which a longer average life is claimed.

The three standard methods of wood preservative treatment constitute the pressure process, in which the entire pole or log is treated; the open-tank method, usually adopted for treating the butts of poles; and the brush method, usually applied in the field and in the treatment of a comparatively small number of poles. These processes involve the use of both creosote and carbolineum as preservatives, and only the butt treatment is usually adopted for cedar poles required in transmission lines.

The three open-tank methods adopted by the Western Red Cedar Association are outlined in specifications prepared by that organization, designated as "A," "AA" and "B."

Treatment "A" requires a four-months' period of seasoning and the removal of fibrous inner bark preparatory to treatment. The poles are then placed ver-

tically in an upright tank in which the butts are submerged in carbolineum, produced from pure coal tar, for a period of 15 minutes. The preservative is heated to a temperature of 215° F., at least once during every four hours' treatment, and it is required that it shall not fall below 180° nor exceed 230°.

Treatment "A" provides for the same preparation and methods of butt treatment as are required in "A," but requires the use of creosote instead of carbolineum. In this case, it is specified that the creosote shall be a coal-tar distillate and which must become completely liquid at 38° F. As in the use of carbolineum, the creosote is required to be used at 215° F.

Treatment "B" provides for placing the poles with butts downward in an upright tank, as shown in the accompanying illustration, for immersion first for four hours in hot creosote and then for two hours in a bath of cold creosote. The creosote oil for hot treatment is specified to be heated to 212° F. and for the cold bath at not to exceed 112° F. This double treatment secures deep penetration—about 50 to 75% penetration of the sapwood. In this treatment the hot oil expands the cells of the sapwood and the cold oil contracts them, causing an expansion and contraction of air in the cells which results in drawing the oil deeply into the wood.

It is considered impossible in the treatment of cedar-pole butts to secure a penetration deeper than the sapwood, as the oil penetration is resisted by a fibrous growth between the sapwood and the heartwood, and a penetration deeper than the sapwood is not necessary because decay at the ground line always starts at the outside and works inward. But the penetration of the sapwood must be to a depth sufficient to overcome volatilization of the preservative oil.

Many pole users have been content with the cheaper installations of untreated poles, with the resultant shorter life and the inevitable higher maintenance costs of the line.

Another wasteful practice has been to install poles of somewhat larger diameter than actual service requires, to allow for a certain amount of deterioration by decay before replacements become necessary. Thus, if a pole of 28-in. circumference is all that is required to support the line safely, a pole of 36-in. circumference is selected to allow for a 1¾-in. depth of decay, and still leave a pole of a size to sustain the load. The adoption of a pole of the smaller size and giving it an effective butt treatment, would be far more economical in the long run and much less wasteful of timber resources. That is, the longer life obtained by choosing a pole unnecessarily large could have been secured by selecting a pole of just sufficient size and giving it a preservative treatment.

The height of butt treatment is determined by the length of poles and the height of the ground line. Thus, a 20-ft. pole, sunk to a depth of 3½ ft., would require a 5-ft. height of treatment; a 30-ft. pole, set at a depth of 6 ft., would require a 7½-ft. height of treatment.

The illustration given herewith shows the treatment plant of the Western Cedar Pole Preservers, at Sand Point, Idaho. The stockholders in this concern are the members of the Western Red Cedar Association, of Spokane, Wash., and its operations are confined to the treatment of poles for those members. In this plant equipment is provided for pole-butt treatment by the "A," "AA" and "B" processes described above, of which the double treatment by hot and cold creosote is required in most cases. The plant has a capacity for treating four carloads of poles per day by the "B" method and is operating at about that capacity. The equipment comprises two 20,000-gal. steel working tanks, circular in form, for hot and cold creosote, rectangular treatment tanks and a round sump tank of concrete, and a 50,000-gal. storage tank for creosote and the necessary steam-boiler plant. In the illustration a locomotive crane is shown in service handling the poles.

RECENT IMPROVEMENTS IN AND FACTORS INFLUENCING INDUSTRIAL CONTROL EQUIPMENT.

Abstract of Paper Presented Before Association of Iron and Steel Electrical Engineers.

By H. D. James.

Westinghouse Electric & Manufacturing Co.

It is not probable that radical changes will be made in the general design of magnetic contactors, as experience has shown that the clapper type of magnet is more reliable than the coil and plunger type, and it is desirable to have all of the essential parts removable from the front of the board. An effort is being made to reduce the number of parts and to use as few different sizes as possible.

A careful study of the design of magnetic contactors and other control apparatus, together with our accumulated experience, enables improvements to be made which reduce the wear and maintenance and decrease the liability to freezing or failure of operation. A consideration of any contactor shows that the essential part of the device is the contact and arc rupturing means. Whether the contact is closed by hand, by magnet, or by an air cylinder, the important part of the problem is the ability of the contactor to handle the current and to stand up under repeated operation. The rolling contact is the most reliable type now in use, but an analysis of various designs indicates a considerable variation in the performance of this contact.

In the rolling contact the movable contact member is usually attached to the armature of the magnet and mounted on an auxiliary pivoted member which will be designated as the contact support. The pivot of this contact support approaches the stationary contact through the arc of a circle and the movable contact is tilted forward so that its tip comes in contact with the stationary contact tip. A further movement of the magnet armature causes the movable contact to roll against the stationary contact until the heels or bottom parts of the contacts are in engagement. The relation between the pin, around which the contact support rotates, and the position of the contacts is an important part of the design. The action of the contacts against each other cannot be a true rolling action, as the contact support hinge pin rotates through a circle and therefore its center moves up and down, due to this rotating action. The least amount of roll is obtained when the moving contact center is located so that it moves at an equal distance on either side of the line drawn from the heel of the contact to the armature hinge pin. Even with the above arrangement of centers there is always sufficient sliding action to keep the contacts clean. Any excessive sliding action causes additional mechanical wear on the contacts and in this way reduces their life.

An excessive sliding action is a disadvantage from another point of view. If the surfaces of the contacts

become rough, they have a tendency to lock together and prevent the sliding action. While this locking together is not absolutely positive, it has been found sufficient in cases where the sliding action is excessive to prevent the armature of the magnet from sealing. This can be readily understood by considering two gear wheels in mesh with each other and an effort to move one gear relative to the other at the same time that they are rotating.

When a magnetic contactor is closed the contacts strike together with considerable force and there is a slight rebound. This is true of any two elastic bodies coming together; the motion is arrested and a slight rebound takes place. When the contact rebounds it draws a small arc which softens the surface of the contacts at the point where they touched. If these contacts are permitted to come together at the same point after the rebound, there will be a decided tendency to weld or freeze, due to the softened metal parts coming into contact. This re-establishment of contact at the same point is prevented by the closing movement of the magnet armature. During the period of rebound, the armature has travelled closer to the magnet core and the center carrying the contact support is in a new position, so that contact is re-established at another place.

The closer the contact support hinge is to the heel of the contact, the quicker the rolling action, and therefore the less liability to freeze. With a long slow roll, the opportunity to weld or freeze seems to be very materially increased. It is possible to obtain a welding of these contacts by energizing the closing magnet and then immediately de-energizing the magnet in such a way that the contacts will just touch and then drop away. With a slow-acting magnet and a long roll contact, it is easier to obtain this condition than where the center of contact support is close to the contact. This condition is the only one under which a well-designed contact will weld on normal overload current.

The closer the center of contact support is to the contact, the greater the lever action exerted by the closing means and therefore the greater ease with which a welded contact may be broken apart. This is of particular value in connection with manually actuated contactors, as these are more likely to be welded, due to improper operation. If the contact is closed by a cam, the operator can exert a very powerful force to break open any ordinary weld.

Importance of Magnetic Blowout.

The life of the contacts and arc box depends upon the efficiency of the magnetic blowout. The function of this blowout will be better understood by a brief description of the action which takes place in the arc box. The arc may be considered as consisting of a stream of positively and negatively charged gaseous particles or ions that travel rapidly from one contact to the other under the influence of the electrostatic field, which is established between the contacts by the line voltage. This stream of rapidly moving ions constitutes the arc current between the contacts; since it is a flexible conductor it can easily be stretched out lengthwise or readily deflected. If a transverse magnetic field is applied to this conductor, the reaction between the conductor and the field will be similar to the action which takes place in a motor where a conductor carrying current is placed in a magnetic field. The conductor moves in the same direction as it would in a motor. This movement increases its length, which cools the arc gases and increases the resistance to the flow of current. The increased length makes it more and more difficult for the voltage across the arc to maintain the flow or ions, until the arc becomes unstable and is finally ruptured. The length of the arc depends upon the amount of current flowing when the arc is established, upon the voltage between the contacts and upon the stored energy in the circuit. The length of this arc may readily be influenced by the design of the arc box and blow-out field.

In addition to the ions, which makes up the flexible conductor, some stray ions accumulate in the arc box. If the distance between the contacts is small, the voltage between the contacts may cause these stray ions to reestablish the arc by forming a new flexible conductor. Oscillograph records show that the arc is sometimes re-established two or three times before it is finally interrupted. The re-establishment of the arc depends upon the design of the arc box and the separation of the contacts. The higher the voltage, the greater the separation required. If two contactors are used in series, there is much less liability of the arc re-establishing itself. The two breaks in series also assist in rupturing the arc, as they require the maintenance in series of two flexible conductors made up of ions, they also distribute the heating effect between two or more arc boxes so that it is much easier to cool the arc.

To rupture an arc, it is necessary (1) To lengthen this arc, so as to increase the resistance, and therefore decrease current, and at the same time, to cool the arc. (2) The contacts should be separated far enough to prevent a re-establishment of the arc or two or more breaks should be used in series for this same purpose.

The cooling of the arc vapor and lengthening of the arc path is usually accomplished with a magnetic blow-out. This lengthening and cooling may be materially assisted by interposing barriers or arc splitters in the path of the arc. In this manner, the ions, which maintain this arc stream, are not only cooled and discharged by contact with the sides of the arc box and the surrounding air, but are also cooled by coming in contact with these arc splitters. The length of the arc is also materially increased while it is still under the influence of the blowout field, by stretching it across these arc splitters. The projection or throw of the arc beyond the edge of the arc box is therefore decreased and much more energy can be broken in the same size of arc box. If the arc extends a considerable distance beyond the edge of the arc shield, it ceases to be under the influence of the magnetic field and may continue to hang on for an appreciable length of time. The burning on the contacts and arc box for any given current depends directly upon the length of time the arc is maintained. The further the arc must travel in order to be ruptured, the greater the time for burning. By using these arc splitters, the arc is extinguished more quickly and therefore the amount of burning is decreased.

The material of which the arc shield is made bears an important relation to the duration of the arc. A good many asbestos compounds, now in the market, contain a binder, which is fused by the arc and forms a conducting skin on the side of the arc box. It is therefore very desirable to construct arc boxes of material which does not form a conducting skin. The more refractory the material, the greater the life of the arc box.

Editorial Comment

Street Lighting and Accidents

STREET lighting has long been recognized as having three main functions. It helps one who has to venture out on the streets after dark to find his way and locate his destination, to go without molestation by those maliciously inclined, and to avoid collisions, falls and other accidents. With the steady growth of automobile traffic in recent years there has been a tendency to increase of street traffic accidents, both by day and night. The far from satisfactory condition of the average automobile headlight has contributed to the latter increase, but it is generally realized that improved street lighting would materially decrease the number of traffic accidents at night. To focus attention upon the subject it was desirable to have definite data available on the effect of darkness upon street accidents and to what extent these might be reduced by modern street lighting.

Data on this matter have now been gathered as the result of an analysis of street traffic accidents in Cleveland, made by Mr. Ward Harrison of that city and reported in an article in this issue. He shows conclusively that there is a big increase in accidents during corresponding hours of summer and winter when daylight and darkness prevailed. In the well lighted part of the city this difference was very small, thus showing the accident-prevention value of modern street lighting. It would be desirable to confirm these findings by definite figures extended over a numzer of years, if possible, and including other cities.

While no one has seriously questioned the safety value of street lighting, data like these are of great intrinsic value when it comes to advocating proposed lighting betterments before city councils and other municipal authorities. Just as with industrial lighting, if one can show concrete benefits in lives saved or accident damages avoided, the arguments make much more impression than abstract statements and generalities.

Some Considerations in the Electrification of Coal Mines

WITH the agitation for higher rates of remuneration and shorter working hours—the bituminous coal miners are demanding a 60% increase in wages and a 5-day week of 6 hours each—to which must be added the fact that a very large number of foreign-born miners are going back to their native countries, coal-mine operators face today the very serious problem of combating increasing costs on the one hand and curtailed production on the other. There is but one solution to this problem, and that is to utilize to the full mechanical methods of mining and apply them most efficiently.

This means, of course, in nine cases out of ten, electrification. And electrification, efficiently carried out for most economical investment, the greatest reliability and minimum operating charges, means the purchase of central-station power, the employment of electricity as the working agent in almost every phase of getting the coal from the ground to the railroad car, and scientific secondary or underground distribution throughout the mine so that line losses and local trouble are minimized and shutdowns localized.

In going over to central-station service, installation costs must be kept to a minimum because there is sometimes small margin between central station and isolated plant costs, not capitalizing the other advantages of purchased service. However, the high value of coal, the value at which it might be marketed if not burned for power purposes, is making the margin wider and wider. In other instances, the lower the cost of supplying service, the greater the profit in the utility. In all cases, therefore, it is to the advantage of someone, frequently of everyone, that the cost of delivering "service" be a minimum. Elsewhere in this issue appears an article by Mr. H. W. Young on the "Outdoor Substations in Connection with Coal-Mining Installations," a solution to keeping the cost of delivery service down. There is little to be said further in this connection, for most of us know what Mr. Young has done toward making the outdoor substation what it is today. These columns have advocated the outdoor substation for so long and for so many applications that our readers must have learned our doctrine of "do not house what does not need housing."

An outdoor substation, *per se,* may with a little modification of detail but retaining the same salient features be used with equal success and effectiveness indoors—throughout the mine. In both instances reliability, economy of cost and flexibility are the predominating conditions to be met, to which portability must be added for the movable type. The place where service should be delivered is at the mine head. The place for the substation in the mine, or substations, as the case may be, is at the center of gravity of the load. As the center of gravity of the load changes the location of the portable or movable substation should change also, speaking generally. By so doing, the investment in conductors is kept down, energy losses are reduced and voltage regulation is maintained so that equipment and men are not handicapped. Only those that have worked in electrified coal mines appreciate the manner in which low pressure and poor

voltage regulation are answerable for burnt-out motors, flashovers of direct-current apparatus and lost time in general.

The electrification of coal mines during the next ten years is prone to play an important part in combating the high cost and scarcity of labor and the demand for less work and more pay. Coal-mine electrification, unlike many other forms of electrification, calls for frequent adjustments to take care of changed locations of active workings, increase in depth of shaft and similar causes. The substation at the mine head may be expected to remain quite permanent except insofar as increased capacity and extensions may be required from time to time to care for the increased energy consumption taken by the mine. The initial choice of a flexible type of outdoor substation is therefore a fact to be borne in mind.

So, too, the distributing network in the mine will require periodic modification to meet new needs, and to this extent the portable substation is a factor in economical operation, in keeping down the kilowatt-hours per ton of coal mined, the investment in conductors and energy loss chargeable to distribution and voltage regulation.

Coal will play a vital part in our national life for many a day—perhaps forever, so far as we know now. Electrification of the coal mines is not only a matter of lowering the costs of mining and therefore in affecting the cost of coal to the consumer and to industry. Electrification means that coal can be better conserved, since coal can be mined less wastefully and less need be left behind in abandoned workings.

Records for Electrical Departments

IT IS obvious that the value of records depends on how much use is made of them and what results they bring. There are, no doubt, as many errors of omission as commission in this respect in factories, industrial plants, repair shops and the like. Neglecting to keep adequate records is as bad policy as to become involved in complicated record systems which may take more time to maintain than does actual production itself. Where to start and where to leave off is a matter of experience, observation and precaution.

Good practice in keeping records for electric repair shops and for industrial plants and other institutions having an electrical repair and maintenance department is indicated in an article by Mr. R. B. Gerhardt in this issue. While Mr. Gerhardt's suggestions are confined to the electrical departments of steel mills, it can be assumed that the points brought out regarding records of costs, production, inspection and tests will be well taken by any one in charge of an electrical department or repair shop.

The activities of such establishments being so varied, there can never be a great degree of standardization in the keeping of records. "Moderation in all things" seems to apply to records, and should be the rule to follow.

British Water-Power Utilization Progressing While American Waits

ONE of the many matters which the British prime minister is pledged to bring before Parliament when the legislators resume their sittings late in October is hydroelectric power development. Early in the year we particularized certain proposals which were advanced by the Water Power Resources Committee relating to nine potential schemes for Scotland which, if carried out, would upon the then average practice of coal-fired stations represent the equivalent of 1,850,000 tons of coal per annum. At that time it was urged that if some of the aforesaid schemes were to be quickly taken in hand so as to give useful employment to labor in 1919, speedy legislative action ought to be proceeded with giving the Board of Trade power to acquire the necessary rights and instruct engineers to complete their surveys, prepare plans and estimates. Doubtless it was owing to the heavy demands upon Parliament that the matter was delayed. The committee wanted the legislative part of the business to be put through quickly so that actual construction work could be begun in the summer now already past. If the bill now promised for the late months of the year is approved, that may happen next year instead of this, but the schemes or part of them, are now definitely accepted as part of the government intentions respecting the industrial development of the United Kingdom and, failing accidents, the way appears clear for something practical to proceed.

Interest in the matter is not limited to the United Kingdom for a second section has now been issued of the report of the Water Power Committee of the Conjoint Board of Scientific Societies on hydroelectric proposals and achievements throughout the whole British Empire. We publish some extracts from this important document elsewhere in this issue. It enters in detail into the greatness of the work and the opportunities and again lays emphasis on the need which has been recognized by careful British electrical observers for some time past of providing more adequate training facilities in British universities and technical institutes for young engineers wishing to take up this branch of the profession.

In the days of cheap coal hydroelectric work was not extensive in the United Kingdom. The colliery workers' wage and other demands, also coal transportation and other costs, have, by doubling the cost of the former commodity, altered the situation in favor of water power. This fact, coupled with the awakening of all parts of the British colonies to the folly of permitting prodigious waste of running water, has placed hydroelectric questions in the forefront of the engineering reconstruction problems of the entire empire, and indeed of practically the whole world. While our British cousins are actively planning, and actually carrying out water-power development, we are in the meantime still waiting on Congress to take some definite action on the matter.

Current Events

Electrical Christmas Campaign — Inductive Interference Survey—S. E. D. Activities—Northwest Association Meets

PRELIMINARY PLANS ANNOUNCED FOR "ALL-ELECTRICAL CHRISTMAS."

Society for Electrical Development Makes Survey of Electrical Trade Conditions and Prepares Plans for Holiday Selling.

Announcement has just been made that the Society for Electrical Development is completing plans to make this an "All-Electrical Christmas." In line with the plans carried out in 1915 for "Electrical Prosperity Week" and in 1916 for "America's Electrical Week," representatives of the society have completed a survey covering 16 states and the province of Ontario, Canada, during which electrical conditions in every branch of the industry were studied at close range.

In most cities the contractors, dealers, jobbers and manufacturers reported the greatest volume in their history. Manufacturers and distributors of electrical specialties are far behind on orders and dealers in these devices are finding ready sale. As one retailer expressed it: "For the first time in the history of electrical appliance selling in this city people are coming into the store to buy large and expensive specialties, which heretofore we had to go out and sell with the hardest kind of selling."

Based upon this information, the society has prepared complete and comprehensive sales and advertising material for holiday selling. This material will comprise posters, colored leaflets, envelope enclosures, cards for counters, cars and windows, form letters and various other advertising matter. It is planned to distribute this co-operative help to the trade at large, as in former campaigns. The society will supply details of the campaign and material upon request. Its headquarters are located at 29 West Thirty-ninth street, New York City.

RAILWAY AND UTILITY COMMISSIONERS TO CONVENE.

Meeting at Indianapolis Oct. 4 Will Be Concerned with Discussion of Transportation and Utility Problems of Readjustment.

The National Association of Railway and Utilities Commissioners will meet in Indianapolis, Ind., Oct. 14. John W. McCardle of the Indiana Public Service Commission will deliver the address of welcome. Governor Goodrich of Indiana, Mayor Jewett of Indianapolis, Clyde B. Aitchison, chairman of the Interstate Commerce Commission, and Max Thelan, director of service for the federal administration, will be among the leading speakers. Three hundred commissioners are expected to attend.

All sessions will be held in the Claypool Hotel and will continue five days. The meeting will largely be devoted to a consideration of reports of special and standing committees, which will cover all phases of railroad and utility regulation. Among the important subjects are public ownership and operation, safety of operation, service of railroads, service of utility companies, railroad rates, utility rates, demurrage, express companies, grade crossings, statistics and accounts, capitalization and state and federal legislation. It is expected that the various plans for the return of the railroads to private ownership, as well as the Plumb plan for nationalization of the systems, will be discussed.

The officers of the association are: President, Charles E. Elmquist, Minnesota; first vice-president, Charles M. Condler, Georgia; second vice-president, Joseph B. Eastman, Massachusetts; secretary, James B Walker, New York; assistant secretary, L. S. Boyd, Washington, D. C. The association comprises all of the railroad and public utility commissions in the United States, as well as those in Hawaii and the Philippine Islands. There are now 53 different commissions belonging to the association, representing every state in the Union with the exception of Delaware, which is the only state having no regulatory commission.

ELECTRICAL EXPORTS FOR JULY FAR BELOW RECORD.

Serious Slump From the Record Figures of June, but Substantial Increase Over July of Last Year.

Figures for the July electrical exports just made public through the monthly summary of the foreign commerce of the United States issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., show a very decided drop from the phenomenal total of last June, when there was reported an aggregate of $10,990,717. However, as compared with July of 1918 there was an increase of over 11%.

The detailed figures for last July and those for the corresponding month of last year are given in the following table:

Articles.	July, 1919.	July, 1918.
Batteries	$ 379,021	$ 240,640
Carbons	70,991	100,098
Dynamos or generators	475,271	283,407
Fans	142,103	105,823
Heating and cooking apparatus	156,745	64,822
Insulated wire and cables	659,893	477,448
Interior wiring supplies, including fixtures	160,099	135,221
Lamps—		
Arc	835	521
Carbon-filament	4,076	6,775
Metal-filament	240,719	309,919
Magnetos, spark plugs, etc.	203,809	151,821
Meters and measuring instruments	125,589	236,019
Motors	546,794	943,006
Rheostats and controllers	26,854	18,730
Switches and accessories	403,748	186,086
Telegraph apparatus, including wireless	44,892	30,710
Telephones	274,387	296,970
Transformers	285,496	287,459
All other	1,794,783	1,518,470
Total	$5,996,105	$5,393,949

These figures do not include electric locomotives, which are separately listed in the government reports.

INDUCTIVE INTERFERENCE COMMITTEE MEETS IN CHICAGO

Data to Be Collected by National Electric Light Association Sub-committees.

The first meeting of the newly formed Inductive Interference Committee of the National Electric Light Association was held in Chicago on Sept. 22 and 23. It is the purpose of the committee to study the inductive interference situation and its relation to practices of the power industry.

The discussions, with the deep interest which they evidenced, brought out clearly the increasing seriousness of this situation, due primarily to the rapid multiplying of the circuits of all parties concerned, to the ever-increasing susceptibility of telephone circuits attendant upon new advances in the telephone art, and to the lack of understanding of generally satisfactory methods of controlling the disturbing effects.

Plans were developed for organizing and inaugurating the committee's work in pursuance of which two sub-committees were appointed, one for the purpose of collecting general data pertinent to the subject and the other for studying the problems being encountered.

The efforts of the former sub-committee, of which S. G. Rhodes is chairman, will include the gathering and analyzing of all available data of actual cases of inductive interference, with descriptions in detail of the causes, nature and extent of disturbance, measures of relief applied, allocation of expense involved and other conditions. Any company that has experienced troubles of this character can lend effective support to the committee by contributing its information, mailed to W. C. Anderson, technical secretary, National Electric Light Association, 29 West 39th street, New York City.

The latter sub-committee, of which H. B. Gear is chairman, will work toward building up a centralized agency for assisting power and lighting companies to arrive at sound and proper solutions of their inductive interference problems, and for effecting a closer co-operation in matters of this nature.

The chairman of the Inductive Interference Committee is A. E. Silver, Electric Bond & Share Co., 71 Broadway, New York City.

ELECTRICAL MEN GIVE LUNCHEON TO EDWARD N. HURLEY.

Testimonial of Appreciation Presented by the Society for Electrical Development.

At a luncheon given on Sept. 19 at the Engineers' Club of New York in his honor by prominent men of the electrical fraternity, representing the Society for Electrical Development, Edward N. Hurley was presented an engrossed parchment testimonial expressing appreciation of his work while head of the United States Shipping Board.

The presentation was made by J. M. Wakeman, general manager of the society, who said, in part:

"When the United States entered the war it was already well recognized that ships were the all important weapon needed to keep the world safe from the hordes of barbarians who threatened it. Among the most notable achievements of this great country was the rapid construction of those vitally important ships.

"Representing the officers, directors and members of the Society for Electrical Development, I take the greatest pleasure in presenting you with this engrossed copy of the resolution passed by the directors and bearing their signatures, testifying their appreciation of the valuable and truly wonderful services you, as chairman of the United States Shipping Board and chief executive of the Emergency Fleet Corporation, rendered not only to this country, but to the entire world. Your work, Mr. Hurley, will be given a prominent place in history and we rejoice in the feeling that you are one of the oldest members and staunchest friends of the Society for Electrical Development. We feel honored that we are permitted to thus record our appreciation of your great achievements."

In acknowledging the presentation, Mr. Hurley said among other things: "I resigned my job with the Shipping Board to get back to the electrical business and I have spent some six weeks investigating what has been going on since I left it to take up governmental work. I am astounded at what has been done. In Washington, during the war, I was present when the question of doing something for the street railways of this country came up. I was asked to aid in the problem of bringing about some sort of an adjustment. Because I have always been interested in the success of the electrical industry, I complied.

"No industry has tried to help people more than the electrical, and that includes the street railways of this country, and no other industry can be of so much benefit to the people of this country. We are before the people more than any other industry and the country cannot afford to ignore the situation existing in the street railways, when they have difficulty in paying their fixed charges. They and everybody connected with the industry are doing one thing—trying to give service. And it is discouraging to feel that the public doesn't understand. They must be brought to understand, and that is one function of the Society for Electrical Development. It is to make people understand, to aid in helping all men of the electrical industry to get together, to hold hands and to stay together. Gentlemen, we must all hold hands, with each other and with the public, or I am frank to say some very important industries will be crucified.

"I think the whole electrical industry can well take to heart this message: Hold up your head and BE OF SERVICE. That is the thing the electrical industry exists for—to BE OF SERVICE."

The parchment is signed by the following directors of the Society for Electrical Development:

Henry L. Doherty, president, Cities Service Co.

James H. McGraw, president, McGraw-Hill Co.

Joseph E. Montague, vice-president, Niagara Electric Service Corp.

E. W. Rockafellow, Western Electric Co.

Fred B. Adam, president, Frank Adam Electric Co.

James R. Strong, president, Tucker Electric Construction Co.

L. P. Sawyer, National Lamp Works of General Electric Co.

Fred Bissell, president, F. Bissell Co.

Walter D. Steele, vice-president, Benjamin Electric Manufacturing Co.

Earnest McCleary, president, McCleary-Harmon Co.

Charles W. Price, chairman of board, ELECTRICAL REVIEW.

J. Smieton, Jr., secretary and treasurer, Society For Electrical Development.

J. M. Wakeman, general manager, Society for Electrical Development.

CANADIAN GENERAL ELECTRIC JOINS SOCIETY FOR ELECTRICAL DEVELOPMENT.

Company Receiving Suggestions for Large Display Rooms and Greater Co-operation with Contractor-Dealers—Other Canadian Firms Joining.

The Canadian General Electric Co., with headquarters in Toronto, Ont., has become a member of the Society for Electrical Development, as have several other Toronto electrical firms, chiefly contractors and dealers. It is planned to extend the work of the society throughout the Dominion of Canada on an increased scale. The Honorable Frederic Nicholls, who for over 30 years has been prominent in Canadian electrical industrial activities, is president and general manager of the Canadian General Electric Co. A. S. Edgar, supply sales manager, together with Mr. Horton and Mr. Mallett, from the main office, have been spending considerable time in the New York offices of the society planning the co-operative work.

The Canadian General Electric Co. is building a new structure to house what will be the finest and most complete electrical showrooms in Canada. Many unique features will be incorporated in this department, which will be operated largely for the convenience of the contractors and dealers of Toronto and the surrounding cities. There will be rest rooms, consultation rooms, with stenographers in attendance, rooms for demonstrations of electrical appliances and specialties and provision made for carrying on a vast educational work within the trade.

CALL FOR ANNUAL CONVENTION OF JOVIAN ORDER ISSUED.

Meeting to Be Held in Chicago on Nov. 5 and 6 to Decide on Reconstruction or Disbanding of the Order.

The seventeenth annual convention of the Jovian Order will be held in Chicago, Nov. 5 and 6, at the Hotel Sherman, following a meeting of Jupiter's cabinet called for Nov. 4. The Jovian Order, like other similar bodies, because of retrenchment made necessary during the World War and changed conditions within the electrical industry, suffered during the past several years a material decrease in membership and income.

This impairment of finances and man power has reached a point so serious that some exceedingly resultful measures of reconstruction must be placed in effect or the order abandoned. This condition was defined in a resolution adopted by Jupiter's cabinet at a meeting held by that body on June 6, to the effect that this annual convention be petitioned by the cabinet to either disband the order or provide assured sources of revenue sufficient to cover a definite budget that will permit the order to realize the great potential good that rests within it.

The Jovian Order has been in existence 20 years. The fundamental principles upon which it was founded and for which it asked the support of the electrical industry were sound at the time of its inception, they are sound today, and will remain sound. The order has accomplished much within the industry.

It is believed by a considerable number of officers and members that the Jovian Order is far from a state of hopelessness; that it can be saved; that it can be guided and rejuvenated to high estate, to become an instrumentality of tremendous usefulness to our great industry, and to each of the mites and mighty that make that industry. Hence all interested in the revival of the organization and who treasure pleasant memories of its days of power and good are urged to attend the convention next month.

MEMBERSHIP CAMPAIGN OF WESTERN SOCIETY OF ENGINEERS.

Intensive Drive Is to More Than Double Membership in Six Days—Chicago and Neighboring Engineers Showing Interest.

Mention was made in these columns of an intensive membership campaign to be conducted by the Western Society of Engineers, Chicago. The time originally set was the week of Oct. 6-11, but preparations on a larger scale made it advisable to defer it to Oct. 11-17. A special campaign rally dinner was given on Oct. 9 at the Morrison Hotel to all interested in the drive, which is expected to bring in at least 2000 new members in six days. Fourteen teams are actively at work. On the evening of Oct. 10 a smoker was given to all participants, including prospective members. Six rally luncheons are to be held each noon on the active days of the drive. Engineers in and near Chicago are showing much interest in the campaign and recognizing the advantages of affiliation with this organization of engineers of all branches of the profession, which recently celebrated its 50th anniversary.

Detailed information can be obtained at the society's headquarters, 1735 Monadnock Block, Chicago.

INCREASED USE OF ELECTRIC VEHICLES IN ITALY.

Large Corporation Being Formed to Manufacture and Operate Electrics—Eagerness to Co-operate With Americans.

The shortage of gasoline during the war has brought about considerable use of electric vehicles in Milan, more particularly for heavy trucking. Although with normal conditions gasoline will not continue at its present price of a dollar a gallon, it will always be high in Italy and that of electricity low. The cities of the Po Valley are all level and the roads in the country are very good.

One electric garage in Milan operates electric busses for all of the hotels and also a regular express-truck service between Milan and Bergamo. It is organizing a 3,000,000 lire corporation to manufacture and operate electric vehicles. It is connected with the Soc. Generale Italiana Accumulatori Electtrici, which will make the batteries. This latter concern was a branch of the Tudor group, but has now been taken over entirely by Italians.

The company would like to form a combination with some American concern manufacturing electric trucks. It is possible that considerable business might be done in parts of trucks such as controllers, steel wheels, etc., and even entire trucks minus the batteries if the price was right. The address of this concern can be obtained from the Bureau of Foreign and Domestic Commerce, Washington. D. C., or its numerous branch and co-operative offices in the leading cities of the country, by making reference to file No. 40723.

Northwest Electric Power Men Hold Important Convention

Central-Station Delegates from Four States and Many Visitors Meet at Seattle — Papers and Discussions Deal with Vital Problems — J. B. Fisken Elected President of Association

By W. A. SCOTT

THE electric public utility companies of Washington, Oregon, Idaho and Montana were well represented at the twelfth annual convention of the Northwest Electric Light and Power Association held at Seattle on Sept. 24 to 27, inclusive. This organization is a geographic section of the National Electric Light Association. Close to 150 delegates and guests were registered; included among the latter were 15 representatives of power companies and other electrical concerns of California. The convention was notable for its unanimity of action on important matters, for the ready grasp of problems before it, and for the ability manifested in papers and discussion.

All the sessions were presided over by H. J. Gille, of the Puget Sound Traction, Light & Power Co., president of the association. At the opening of the convention, Mayor C. B. Fitzgerald of Seattle gave a brief address of welcome. This was followed by President Gille's address, in which he first gave a review of the important part played during the war by those trained in the public-utility industries.

President Gille's Address.

Entering then into the affairs of the public utilities, Mr. Gille covered all phases of the subject, showing the problems and duties to be met. The following extracts cover some of the salient features of his address:

"The public, which had been taught that the combination of capital necessary to successfully and economically develop the large public utilities of this country was somewhat of a menace, was suddenly awakened to the fact that it was only by reason of the existence of such development that the tremendous construction necessary to successfully prosecute a great war was possible. Shipyards sprang up almost over night. Large machine shops and other war industries demanding large blocks of power came into existence, and yet this extraordinary demand for electric energy was everywhere promptly met. Nor is there a single record of any electric light and power company seeking in the slightest measure to take advantage of the country's abnormal needs to secure an abnormal profit. With the prices of every other commodity advancing by successive strides, the prices of electric energy remained practically stationary, despite the large increased cost in production and labor.

"Along with the other questions that have profited by the experiences of the past two or three years is that of standardization and equipment. Lamps and appliances have been brought up to a spirit level of quality that would have taken years to bring about had not necessity compelled. And at the same time much that has been worthless and unnecessary in the way of appliances and equipment has been scrapped and such machinery as was employed in the manufacture of our own necessities has turned out goods with the hall mark of quality, benefiting the electrical industry.

"One of the peace-time problems confronting us today is the development of business to employ the energy released from the needs of war production, and the development of the great industrial opportunities on the Pacific Coast, and particularly in the Pacific Northwest. Industrial research for developing industries employing electricity as a motive power should be vigorously prosecuted. I realize that few individual companies, except the large ones, can afford to engage competent investigators for this purpose, and it might be wise for the association to undertake this work along broad lines for the benefit of all member companies. Chambers of commerce, commercial clubs, associations of manufacturers, jobbers and dealers should co-operate with the central-station companies in working out such a plan and in encouraging new industries.

"In the Bureau of Labor statistics of the United States are records of wholesale prices of 240 commodities, grouped under nine heads. The average index number in 1913 was 100; in April, 1919, it was 203. In other words, the wholesale prices of 240 commodities have more than doubled since the date of the first record. For some reason the price of electricity for light and power is not included in this list of commodities, probably because it is included under the class of service. If, however, an index number showing the movement of light and power rates were available, and could be compared with the commodity-price movement, a very striking difference would be observed, as even in the few cases where rates have been increased it was only a fraction of the commodity-rate increase.

"If 100 represented the normal in 1913, the average light and power index number today for all member companies would probably not be more than 115. Our customers who produced these commodities which have increased tremendously in price have benefited by increased profits. In the meantime our own net earnings have not been increased. This statement is made in the face of greatly increased gross earnings, due to increased business, but the business extensions have compelled large additions to our plants and at very high construction costs.

"The furnishing of power for the operation of railroads is a problem that confronts all of the power companies on the Pacific Coast, as well as the intermountain companies. In a period of less than 15 years the manufacturers of electrical equipment have perfected motors for heavy duty, as well as for high

speed, capable of handling the heaviest trains over railroad lines having the most difficult grades. The Chicago, Milwaukee & St. Paul railway has over 400 miles of electrified lines in operation in Montana, the power for which is being furnished by the Montana Power Co.; and the Milwaukee management will place in operation over 200 miles of electrified lines across the Cascade Mountains, in the western division, in the state of Washington, between Othello and Puget Sound, within a short time. The power for the western division will be supplied by the Washington Water Power Co., on its eastern end, and the Puget Sound Traction, Light & Power Co. on the western end. The success of the operation of the Rocky Mountain division in Montana is well known. At a recent hearing before the Interstate Commerce Commission in Portland, evidence was presented showing the economy of electrical operation. The testimony was based upon the authority of comparative records of steam and electrical power, and went into the question in detail, a summing up of which would tend to show that the proportions were 408 to 524 in favor of electricity. The figures were adduced upon a 1000-ton-mile basis.

"The success of railroad electrification is assured, and there is no small reason for doubt that in a short time many of the railroads in the United States will be operated with electric power. The character of the power load for operating a railroad is somewhat intermittent and can be furnished cheaper by a power company on account of a diversified load for light and power, than by a separate power plant. It is, therefore, of the greatest importance that we co-operate with the railroad officials in the working out of economical and reliable power supply.

"In the matter of co-operation between central-station companies, manufacturers, jobbers and dealers, we cheerfully acknowledge the success of the plan developed by our neighbor, the Pacific Coast Section, and I am convinced that a similar plan should be worked out in the Pacific Northwest. Much good has been accomplished in this direction through the efforts of W. L. Goodwin and S. A. Chase, and I would recommend that a committee of this association be appointed to work with the manufacturers and jobbers as well as with the contractors and dealers to bring about practical co-operation.

"Our industry, even outside of its engineering and technical branches, is highly specialized, and our greatest need is for men qualified and properly trained in its various branches. While it is theoretically true that merit and ambition must eventually rise to the top, it is also true that opportunity plays a large part in a man's development. The electrical industry has had a marvelous development by reason of the ability and breadth of vision of the men who have been connected with it. The accomplishments of these men were not accidental, and their opportunities were not a matter of chance, but resulted from their ambition to do one certain thing, in one certain branch of the industry, coupled with the ability of their superiors to seek out and recognize their qualifications. Along that line it is the duty of every manager, and head of department to ascertain what the particular ambition of every subordinate is; to then determine if he is qualified along that particular branch, and if so give him the opportunity of developing himself. It is only by these means that men with particular ability can be found, and when found properly trained to take the places of those who are now doing the work, and carry on."

R. H. Ballard, of Los Angeles, president of the N. E. L. A., being unable to attend, sent a letter to the convention, which was read by the secretary. In this Mr. Ballard delegated A. Emory Wishon, of the San Joaquin Light & Power Co., Fresno, Calif., to represent him. His letter entered briefly into many important matters, giving emphasis to the necessity for greater water-power development; and urged co-operation among all branches of the industry, and the adoption of some method of participation by employes. The matter of good relations with the public and municipal ownership were discussed. Mr. Ballard thought the geographic section was the place in which all differences might be ironed out.

The report of W. E. Herring, secretary-treasurer of the association, was read; it showed a cash balance in the treasury of $5200.

O. B. Coldwell, of the Portland Railway, Light & Power Co., chairman of the Executive Committee, submitted a revision which his committee had made of the constitution for the association, which was subsequently adopted in lieu of the original provisions. It creates a stronger Public Policy Committee in each state, and under its provisions sufficient funds may be supplied for carrying out the plans of such committees.

On the recommendation of the Executive Committee, W. J. Grambs, of the Puget Sound Traction, Light & Power Co., was made an honorary member of the association.

E. Hofer of the *Manufacturer and Industrial News*, Salem, Ore., appeared before the convention, and, in a brief address, discussed matters pertaining

Group of Delegates and Guests from Washington, Oregon, California, Idaho, Utah and Montana in

to the rehabilitation of the public utilities, by securing the co-operation of the public. Concerning labor problems, he advocated voluntary mediation within each industry.

Report of Hydroelectric Committee.

G. E. Quinan, chief engineer of Puget Sound Traction, Light & Power Co., Seattle, chairman of the Hydroelectric and Technical Committee, read the committee's report. This valuable report dealt with revision of the National Electrical Safety Code, standards for transformers, rating of oil switches, turbo-generator fires, inductive interference with telephone lines and other related topics.

The reading of this report was followed by extended discussion, entered into by O. B. Coldwell and L. T. Merwin, of Portland; F. D. Nims, John Harisberger, and others, of Seattle. The convention tendered to Mr. Quinan a vote of thanks for his research and service in preparing the report.

Accounting Methods.

Proper methods of accounting, adaptable to city and suburban electrical business, were treated in a paper presented and read by J. S. Simpson, of the Washington Water Power Co., Spokane. His initial statement was that the object of a set of books was to have it show at any time the actual financial condition of a corporation or firm, and also to meet the requirements in rendering federal and state government reports applicable to public utilities.

In the discussion that followed, the subject of billing customers and making collections received much attention. The plan of maintaining district offices in a city for the convenience of customers and to secure closer personal contact with them received the endorsement of a number of delegates. Under such a plan it was considered important that district managers have complete information at all times as to each customer's account. The method of keeping down billing costs by listing charges for services and goods on one bill had been adopted by some companies. It developed that in some lines of business it is essential that bills be rendered weekly; that the cost of billing and collecting was running too high; that the various companies should compare methods and costs and get away from methods which are cumbersome and expensive. In discussing meter reading, the fact was brought out that continuous meter reading had been found advantageous; and that the plan of allowing the customer in outlying districts to do the meter reading had proved satisfactory. This phase of the discussion was entered into by H. J. Gille, F. D. Nims, L. R. Grant, G. E. Quinan, R. W. Clark, of Seattle; H. L. Walther, Medford, Ore.; O. B. Coldwell, J. D. Scott, of Portland; W. M. Hamilton, Salem; Geo. D. Brown, Wenatchee; L. R. Lewis, Spokane; and E. E. Walker, Vancouver, B. C.

In answer to the question of H. H. Schoolfield, Portland, as to the computing of interest on construction and heavy maintenance, Mr. Simpson, author of the paper on accounting, stated that interest on construction should begin as soon as the money is raised, and cease when the plant was turned over to the operating department; and that no interest should be allowed on maintenance. The subject of depreciation was then discussed. In practice it was declared much of this can be standardized.

The evening of Sept. 24 was given to a lecture on "Electricity Today," by Wm. H. Easton, of the Westinghouse Electric & Manufacturing Co. The lecture attracted a large audience, which included a good many persons outside of the electrical industry. After giving an outline of the rapid development of electrical applications within the last 20 years, Dr. Easton predicted that in the future the adaptation of electrical energy to industries and utilities would be 20 times as great as at present. Numerous lantern slides were used in exhibiting the many applications of electricity in the industries and in domestic and farm life.

Electrical Merchandising.

The second day's sessions were devoted to round-table conferences on electrical merchandising, electric ranges and water heaters. They attracted a full attendance and brought out animated discussion and undivided attention. The round-table discussion in the forenoon, on Improving Electrical Merchandising, was conducted under the chairmanship of L. A. Lewis, Washington Water Power Co., Spokane. Mr. Lewis presented a paper dealing with the relations between manufacturers, central stations, jobbers, contractors and dealers, clearly showing the need of a policy of co-operation. He then called for 5 and 10-minute discussions, in which many took part.

E. E. Walker, British Columbia Electric Co., Vancouver, B. C., took up the attitude of central-station companies toward the merchandising branch, as to whether the tendency was to conduct the merchandising feature as a separate unit, or to run it as an adjunct to power and light production. While in former days, as a means of creating a demand for electrical appliances, it was necessary to mix the two phases of the business, he considered that day past, and that

Attendance at Twelfth Annual Convention of Northwest Electric Light and Power Association at Seattle.

now the merchandising of appliances should be on a profit-producing basis. He realized, however, that in some smaller centers it is still difficult to separate the two classes of the business. He predicted that in most cases central stations will continue in the merchandising business, but that their co-operation with the regular dealers will be such as to be advantageous to the latter, thus resulting in increasing the number of distributors.

John V. Strange, of the Pacific Power & Light Co., read an interesting paper on "Relations with Dealers and Contractors," taking up the subjects of prices, merchandise handled by central stations, and selling campaigns. In most of the larger cities he thought the appliance trade may be well and sufficiently served by local dealers; but in localities in which the central station is a factor in merchandising its competition should be such as to allow the contractor-dealer to live and prosper. He gave the manufacturer credit for accomplishing much in educating the public to the extent of creating a demand for appliances. Pioneering days are over and central stations will serve themselves by encouraging the local dealer.

D. E. Harris, sales manager of Pacific States Electric Co., San Francisco, spoke of the co-ordination of electrical interests in California, and showed how the local contractor-dealer in towns and the smaller cities is able to succeed when he receives the co-operation of central stations and jobbers.

W. S. Berry, sales manager Western Electric Co., San Francisco, referred to the work accomplished in California by an advisory committee of nine members, representing all branches of the industry, and expressed the hope that a similar plan may be adopted in the Northwest. He gave a brief account of the work of the field men working under the direction of that committee.

Robert Sibley, editor of *Journal of Electricity*, San Francisco, in further explanation of the California plan, said it was a method of co-ordinating the interests and services of the four branches of the electrical industry by means of the advisory committee's field men, and the help of the jobbers' salesmen.

Lewis A. McArthur, Pacific Power & Light Co., Portland, in speaking of merchandise accounting, outlined methods of cost keeping, including overhead and profits. The stock, he insisted, should be kept in salable condition and should be regarded the same as cash; and in the possible turnover of two and three times a year he considered the gross profit should not be less than 21%, and an additional 5% should be added if the goods are sold on installments extending over six months. In the sale of appliances to employes, he said the practice had been to make a price of cost plus 10%.

D. E. Harris and others discussed the subject of discounting the customers' paper, and in connection with this the Morris Bank plan was referred to. W. A. Marsden, of Electrical Appliance Co., Seattle, had found it possible to sell washing machines and other appliances in competition with central station and department stores.

Geo. A. Boring, Portland manager for Pacific States Electric Co., spoke of the good services of jobbers' salesmen in advising dealers in sales methods and displaying goods.

A. C. McMicken, sales manager Portland Railway, Light & Power Co., advised against the practice of carrying heavy stocks, but suggested the buying from jobbers in monthly requirements and let the latter absorb the carload discounts. Buying in heavy quantity, he considered, was not justifiable. Let the jobber do it.

Lewis A. McArthur said it was inadvisable for dealers to handle more than one make of each appliance, and W. O. C. Sawyer, of Yakima, supported the same contention. He said that, for instance, after the experience of carrying 4 or 5 kinds of vacuum cleaners, the store of the Pacific Power & Light Co. at Yakima got down to only one kind. The salesman's loyalty is thus not divided by efforts to sell several kinds.

H. C. Schade, of Portland Railway, Light & Power Co., read a brief paper on the experience of selling appliances through employes other than salesmen. It was considered a good method of extending sales and also a means of interesting many employes in the success of the company and in becoming users of appliances themselves. C. M. Brewer, of Mountain States Power Co., Albany, Ore., spoke of his success in selling electric ranges through special salesmen and other employes, and the sale of other appliances by co-operating with dealers. Under this head, A. C. McMicken told of paying bonuses to regular salesmen in the electrical appliance store, and said the plan had resulted in increasing sales materially. The effect had been better than that of a direct increase in salary.

S. M. Kennedy, Southern California Edison Co., Los Angeles, by invitation of President Gille, delivered an interesting address. After speaking of the dual responsibility of central stations—to stockholders and to the public—he turned to the subject of the selling of merchandise by central-station companies. He cut to the core of the question when he stated that the central station's chief interest in the merchandising branch rested in the matter of developing and building up the energy load. Securing and maintaining a satisfactory load for the generating plants in southern California had been accomplished by a system of genuine co-operation among all concerned. As the dealers become strong and effective in caring for the appliance trade, the central stations there gradually relinquish that branch of the business. His company, he said, keeps appliances on sale, but is not an aggressive competitor.

Sale of appliances through employes, other than regular salesmen, was explained and discussed by L. R. Grant, of Puget Sound Traction, Light & Power Co., Seattle, and the discussion was continued by others.

The National Convention of the N. E. L. A. in Southern California Next Year.

The afternoon session of Sept. 25 was crowded with matters of great interest. The first hour was given over to the California visitors. They were invited to speak on the 1920 convention plans for the N. E. L. A., on their California Electrical Development League, and other subjects. The first speaker was A. Emory Wishon, of the San Joaquin Light & Power Co., Fresno, who represented President R. H. Ballard of the N. E. L. A. He spoke of the co-operation of the leading electrical men of California to promote the success of the 1920 convention of the N. E. L. A., and he asked the co-operation of the Northwest. The great idea, by means of that convention, is to bring the East to the West, to bring them into closer contact. The national body was essential, but interest in the geographic sections should also be maintained.

Robert Sibley, referring to the problems of re-

adjustment before the country, said the electrical industry would be a potent factor in working them out. He said the use of electrical energy per capita west of the Rocky Mountains was four times as great as that east of those mountains. The co-operative movement was harmonizing all interests and the ideals of the West were being carried to the nation.

S. M. Kennedy spoke of Mr. Ballard of the N. E. L. A. as a constructive president, and he predicted the convention of the national body, in southern California next May, would be one of the greatest in the history of the association. He asked assurances that the members of the Northwest association would be there in force. On motion of H. L. Walther, of Medford, Ore., the convention went on record in favor of attending the national convention as a body, and O. B. Coldwell, of Portland, was appointed committee to arrange for doing so.

Electric Ranges and Water Heaters.

The round-table conference on this subject was under the guidance of A. C. McMicken, of Portland. The matter was treated under separate heads, including advertising and merchandising. John V. Strange, of Pacific Power & Light Co., read a paper on "Advertising Service," which had been prepared by Mr. Gilham, advertising manager for Utah Power & Light Co., Salt Lake City. A paper on "Merchandising the Electric Range," by J. F. Durge, of Utah Power & Light Co., was read by R. W. Clark, of Seattle. Both papers brought forth interesting discussion. A few of the points made clear were that the first essential is to sell the idea; that service is the basis of success in selling ranges so they will stay sold; the confidence of all employes is an asset, and this can be built up by having them use ranges and understand them; much of the success of electric ranges is due to the wise policy and methods of manufacturers; we should get away from the idea that electric cooking is a seasonal proposition, as it is one of all-year utility; demonstrations in stores and influence of cooking schools are of special benefit; every range should be set up, inspected and tested before it is delivered to the customer.

F. N. Cooley, of Western Electric Co., Seattle, read a paper on "Electric Bake Ovens," by E. E. Rowley. It was shown how this class of ovens for restaurants and hotels and for commercial bakeries had greatly developed. Their great advantages were in perfect distribution of heat, their safety, economy, speed in baking and sanitary features. It was stated that there are 38 electric bake ovens on the lines of Utah Power & Light Co.

D. F. Henderson, of Washington Water Power Co., Spokane, said that company had 1131 electric ranges on its lines, and he gave some account of the new line construction necessary to handle this service, saying the revenue from this source justified the expenditure. He gave some interesting figures on the costs of electric range maintenance. It was explained that ranges were now being sold only in connection with the sale of water heaters.

H. J. Gille called into question the actual profit of electric range sales in small towns and in the country; and R. W. Clark, Seattle, said the prices of ranges had increased, the cost of wiring had also advanced, and he intimated that possibly development of the electric range business had in some cases been at the expense of the central station.

J. C. Henkle, of Portland Railway, Light & Power Co., submitted a valuable paper on "Range Maintenance Methods and Costs," as shown in the operation of that company's service department. He was followed by L. R. Grant, of the Puget Sound Traction, Light & Power Co., Seattle, on rates for ranges, water heaters and similar service.

The features of the last day were the presentation of two important papers and the discussion they brought out. The first was by W. H. McGrath, of Puget Sound Traction, Light & Power Co., Seattle, on "Value of Public Utility War Experiences and Their Effect on the Future." In Mr. McGrath's absence his paper was read by R. W. Clark. The paper referred to the various experiences of the electrical utilities and especially commented on the inflexibility of the present system of rate regulation. Mr. McGrath advocated a national campaign of education to bring the public to realize the economic fundamentals of the public utility business and appreciate the need of more speed in rate adjustments or more flexible rate schedules in order to meet emergency conditions more promptly.

David L. Huntington, president Washington Water Power Co., in discussing Mr. McGrath's paper, considered the position and conclusions of the latter axiomatic and not open to argument. He then took up such matters as taxation, replacements, construction, flexible rates and methods of educating and informing the general public on the problems faced by public utility companies. These he treated in a most lucid manner. S. M. Kennedy advocated the use of newspapers in disseminating information to patrons and the public. A. E. Wishon presented the advisability of interesting local people in becoming stockholders in the concern. The West, he said, could not advance ahead of its hydroelectric development.

The second paper was on "Industrial Heating," by C. A. Winder, of the General Electric Co. Mr. Winder's paper was read by O. L. Coward. The author covered a wide range of subjects dealing with the electric furnace, heat treating, enameling, core baking, welding, fruit and vegetable drying, bake ovens and vulcanizing.

In the discussion, the commercial point of view was given by B. S. Manuel, of Westinghouse Electric & Manufacturing Co.; H. J. Gille spoke on rates for heating loads; G. E. Quinan took up its application to steel furnaces and discussed the matter of load-factor; A. C. McMicken, speaking of rates for such loads, said continuity of service and adaptability were of far greater moment. He spoke of the installation in Portland of the first electric brass furnaces in the Northwest in which a 300-kw. load will be required. Among others who discussed different phases of electric heating were D. L. Huntington, J. King, R. W. Clark, A. A. Miller and F. D. Nims.

The nominating committee presented a list of nominees for officers of the association for the ensuing year. These were unanimously elected by the convention, as follows:

President, J. B. Fisken, chief engineer of Washington Water Power Co., Spokane.

Vice-presidents: F. D. Nims, of North Coast Utilities, Seattle, for Washington; G. L. Myers, of Pacific Power & Light Co., Portland, for Oregon; F. M. Kerr, general manager of Montana Power Co., Butte, for Montana; W. D. Putnam, of Idaho Power Co., Boise, for Idaho.

The convention closed with a banquet at the Army and Navy Club on the evening of Sept. 26, attended by about 150 members and guests.

Commercial Practice

Electric Heating in Typewriter Factory — Progressive Municipality's Electric Range Campaign—Rate Referendum

ELECTRIC HEAT IN THE TYPEWRITER INDUSTRY.

Paper Presented Before American Electrochemical Society's Meeting in Chicago Describes Plant of Royal Typewriter Co.

By A. M. Clark.

Industrial Heating Dept., General Electric Co.

The Royal Typewriter Co., of Hartford, Conn., is one of two companies manufacturing typewriters who bake the finish on typewriter parts in electrically heated ovens in preference to other methods now in use, such as in gas or oil heated ovens.

The installation consists of a battery of six ovens. Four of these ovens are 7 ft. 5 in. high, 7 ft. 1 in. deep, and 6 ft. 2 in. wide, while the other two are slightly smaller. Each oven has a connected load of 27 kw. The heating units which rest on the floor take up very little space and run at a relatively low temperature. This low temperature, combined with the ventilation which is provided, practically eliminates the danger from explosions and fires. The ovens run almost without attention, as automatic control and a time clock insure the desired temperature and the throwing off of the current at a predetermined time.

Oven No. 1 is used for baking japan on the spacer bar of typewriters. These spacer bars are made of soft wood, and are given five coats of a rubber japan, which gives a hard-rubber-like surface which cannot be easily dented. It was found advisable to use a temperature of 250° F. for 3 hours for the first four bakes. The last bake is run at a temperature of 275° F. for the same period of time.

The other five ovens are used for baking japan on the frames, ribbon spools, base plates, top dust plates, back dust plates, front plates, and paper tables. The finish on these parts requires a more complicated system of baking and finishing. In the first of these ovens the parts to be baked, having first been dipped in a metal japan are baked for five hours at 350° F., after which they are rubbed down by hand and again put through the same process in the second oven. Before being placed in the third oven they are sprayed with a black-baking japan and baked for five hours at 400° F. After this bake the parts are all sanded and rubbed clean and the same operation is repeated using the fourth oven. They are then rubbed down by hand with a hard piece of felt and powdered pumice, giving them a very smooth dull finish, sprayed with the same black-baking rubbing japan and baked for five hours at 400° F., when they are ready for the final assembly of the typewriter.

These ovens have been in operation for more than four years and have proven very satisfactory.

The following tables show the comparative capacity and cost of operation of two of the ovens, one equipped with gas and the other with electric heating equipment. The second table shows the comparative cost of gas and electricity per day, per month, and per year, and a saving per year of more than 20%, or $360.36 for each oven.

Summary of Fuel Costs per Bake in Japan Ovens.

	Electricity.	Gas.
Capacity	300 frames	180 frames
Capacity	3,288 lb.	2,055 lb.
Fuel used per bake	123 kw-hrs.	1,100 cu. ft.
Rate	$0.015 less 40%	$0.85—12% = $0.75
Cost per bake.	$1.10	$0.825
Cost per frame	$0.00366	$0.00458
Cost per pound	$0.000334	$0.000401

Fuel Cost—Full Time.

Cost per day..	$ 4.62	$ 5.78
Cost per month	120.12	150.15
Cost per year..	1441.44	1801.80
Saving per year	360.36	

or 20% of present costs, without allowance for savings in defective bakes.

From the above it is evident that the Royal Typewriter Co. under the conditions existing in Hartford, Conn., is able to effect a considerable saving in dollars and cents by using electrically heated ovens. A superior finish without any increase in the cost of labor is also an item which makes the electrically heated ovens desirable.

In addition to the above, the Royal Typewriter Co. has found that electric heat proved advantageous in other ways as well. With gas-heated ovens their experience showed that owing to burning, underbaking, dust and variations in the heat, a certain percentage of bakes was lost. It was also found that with electric heat they get a superior and uniform finish, which is durable and does not easily chip off.

There are a number of companies manufacturing typewriters who are undoubtedly contemplating the installation of electrically heated ovens to bake the finish on typewriter parts. As this method is economical and insures a very good and uniform finish, it should not be long before the typewriter industry is using electrically heated ovens exclusively.

PROGRESSIVE MUNICIPAL ELECTRICAL PLANT MAKES GOOD HEADWAY WITH ELECTRIC COOKING.

Beloit Light and Water Department, City of Beloit, Kans., Finds Publicity and Propaganda Get Results.

By F. A. Darst,

Superintendent, Beloit Light and Water Department, Beloit, Kansas.

The Light and Water Department of the City of Beloit, Kans., has been carrying on a "Cook with Electricity" campaign during the past summer with results that are very gratifying. As the system is quite small, as are also the number of customers, relatively speaking, it may be of interest to tell what has been the effect of this electric cooking campaign upon the

station output; and the manner in which this form of load is supplied.

Beloit is a town of 3750 population, and operates a municipal electric light and water plant, the total generating capacity of the electric light plant being 270 kw. The city does not sell electrical appliances or supplies but leaves this business to the merchants. This department does, however, help to interest prospective consumers in the use of electricity for various purposes, and as soon as a customer or prospective customer is found, the dealers are apprised of the fact at once. One of the dealers handles Hughes ranges, another one handles Westinghouse ranges and a third dealer handles General Electric ranges.

Last spring when a range campaign was commenced the Beloit Light and Water Department had 36 electric ranges connected to its transmission lines and today it has 73 electric ranges in service. I believe, when we began our campaign, every one of the 36 electric range consumers were absolutely satisfied with electric cooking and we used them as living advertisements, referring to them very frequently when talking to prospective range patrons. Next year we will double our present number of electric ranges in use without any trouble, as we find the demand is still very good. One of our dealers sold three ranges in one week and another one of the dealers sold two, and I have been informed that they have several more prospects for ranges this season.

Our range rates are as follows: Twelve cents per kw-hr. for the first three kw-hrs. consumed, per room per month, and 4 cts. per kw-hr. for the remainder. Minimum rate, $1.50 per month.

With this rate the municipality is able to obtain a very large appliance load which it would not otherwise be able to obtain.

The output of the municipal plant for the months of May, June and July was 146,174 kw-hrs., divided as follows:

Sold to consumers,

Lights	46,314	54.3%
Power	16,847	19.8%
Ranges and lights	22,140	25.9%
Total sold	85,301	100. %

	kw-hrs.
Total sold consumers	85,301
Used pumping water	19,763
Used street lighting	10,031
Used at plant	6,203
Unaccounted for	24,876
	146,174

From these figures it will be noted that the range business has added materially to the current sold. The output increased during these months from a total of 46,267 kw-hrs. generated during the month of May to 58,125 kw-hrs. generated in August, which is a gain of 20.4%.

It has been the experience of the municipality that the diversity-factor of the range load is such that in practically every instance where the transformers were previously large enough to carry the lighting load that they will also carry our added range load. No trouble has been experienced in carrying four ranges on one 5-kv-a. transformer and there are as many as eight ranges on one 10-kv-a. transformer.

The Beloit Light and Water Department has used the reverse side of the light and water receipts for advertising electric cooking and also the local daily paper.

Service connections for range consumers are made with No. 8 weatherproof wire and 25-ampere three-wire meters are used on this class of services, connecting lights and range on the same meter. At first separate services were used and separate meters for light and range services but the one meter method has proven much more satisfactory.

The municipality's electric ranges are competing with coal which sells at $9.50 to $11.00 per ton, and it is due to the high fuel cost that we are unable to give a better than a 4-cent rate on this class of service.

ELECTRIC CONSUMERS ASKED IF RATE INCREASE IS JUSTIFIED.

Central-Station Company Gives Customers Opportunity to Express Their Opinion as to Rates to Public Utility Commissioners.

The Commonwealth Electric Co., Summit, N. J., has adopted rather novel means to win the support of its consumers in connection with a proposed rate increase of 1 cent per kw-hr. for light and power, and ½ cent per kw-hr. for cooking service. The company recently made application to the Board of Public Utility Commissioners for permission to make this advance in its rate schedule and immediately following mailed a circular letter to its customers enclosing a blank form to be returned signed with an expression of views. This letter read in part as follows:

If you do not feel that the company is reasonably entitled to make this increase (10%) in the rates you should tear off this slip, sign it with your name and address and mail it to the company at once. It is the desire of the company that every one of its consumers should have an opportunity to express their views to the Public Utility Commissioners, who, as you know, are the judges and jury in such matters, and this company will present to the commission all slips which are returned properly signed.

In explanation of this action the company sets forth that it believes that its patrons desire it to maintain a first-class quality of electric service and that they are willing to pay for such service whatever may be a just and reasonable charge. The company has endeavored to maintain adequate service during the war, irrespective of the cost, and believes that the service has been of the best quality and thoroughly satisfactory to customers.

COMMERCIAL ACTIVITIES OF BOSTON EDISON ELECTRIC ILLUMINATING CO.

Commencing September 2, the Edison Electric Illuminating Co. of Boston started to finance its own lease sales on such electric appliances as washing machines, vacuum cleaners, dish washers, etc. During the war, when financial conditions were "tight," and public utilities had to retrench in outlay of men, materials and money and when the Government asked that expenditures be curtailed to an absolute minimum, the company arranged that their customers make purchases of current-consuming devices through payments made through the Morris Plan Co. when buying on installments.

The company, in going back to its pre-war method of selling the higher priced devices, states it is very glad to once again come into the closer contact that always occurs when direct payments are made by their customers. The company in financing sales is charging 8% on deferred payments.

Operating Practice

Transmission Structures of Steel and Wood — Cooling Coils—Portable Blower for Cooling Underground Cables

COMPOSITE TRANSMISSION STRUCTURES OF STEEL AND WOOD.

Abstracts from O-B Bulletin Tell War Practice of Alabama Power Co. to Reduce Line Costs and Increase Life of Supports.

By F. C. Weiss.

Superintendent, Line Construction, Alabama Power Co.

During the period of extreme high prices of transmission line materials the construction of priamry lines was limited to those serving essential war industries. Where conditions gave an opportunity for utilizing such construction so that it could be operated in post-war times for commercial purposes, the installations were designed along lines of a more permanent character.

In 1918 the Alabama Power Co. was confronted with just such a problem on a 27-mile transmission line from its Bessemer substation to Gorgas, Ala. A 110-kv. connection for these two points was necessary. The high cost of right-of-way necessitated the construction of a double-circuit structure. This developed the problem into a matter of high price of steel and the necessary approval of the War Industries Board.

A composite structure of wood and steel was found to be the most economical under the conditions outlined above. Accordingly, test towers were constructed and various loads applied; finally the towers were tested for destruction.

The tests developed the weak points in exact accordance with the engineers' figures. The design of the wood-steel joint was perfected and steel work adapted to more economical erection costs, and the Alabama Power Co. then proceeded with the construction of this new type of tower which showed an over-all saving of more than 10% on the entire line over standard steel towers figured on a basis of market prices of July, 1918.

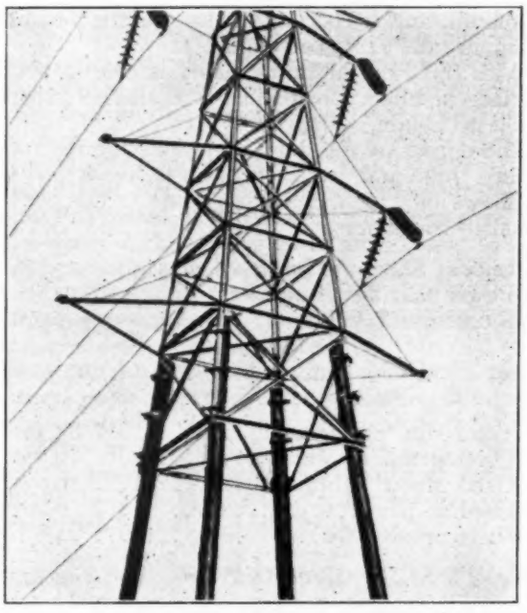
Two types of towers were used, one with four legs and one with two legs. The basis of the line was a two-legged structure with four-legged structure at points of special stress and at intervals of not more than one mile. The result is a line of semi-flexible type with more than ordinary stiffness.

The two-legged structure consisted of two creosoted long leaf yellow pine poles supporting 1750 lb. of galvanized steel super-structure. The four-legged towers consist of four creosoted long leaf yellow pine poles supporting 2750 lb. of galvanized steel superstructure. The normal spacing at the base is 15 ft. using 50-ft. poles with 8-in. tops. The steel superstructure is 32 ft. in height, clamped by steel bands to five feet of timber, making a mechanically strong and also a neat appearing wood-steel joint. Wood filler blocks perfected the fit from pole to channel section on two-legged structure and to angle section on four-legged structures.

The structures are designed to carry two galvanized steel 3/8-in. ground wires and two No. 2/0 copper three-phase circuits, insulated by 7 units Sanitary O-B suspension disks. The standard span is 700 ft. with maximum span of 2100 ft. The country traversed by the line is very hilly and to take care of side hill construction as well as special crossing clearances some 60-ft. poles are used in conjunction with the standard 50-ft. poles. A grounding wire is used on each pole and pole steps provided for workmen.

The poles were set as it is customary in pole construction. The depth of pole hole is 7½ ft. in normal instances and back-filling was done with dry mixture of cement with earth as found. This back-fill gives reasonable protection against side strain.

The steel structures are designed so that the lower 8 ft., including the wood-steel joint make a separate section. This section is used as a template, in squaring and aligning the structures after the poles are placed and properly back-filled. The additional steel work is handled by means of a small gin-pole mounted on the tempate section. This class of construction is very difficult to handle without especially trained workmen.



Composite Wood and Steel Tower.

An analysis of costs indicated that the labor charges on this line were the same as for the standard 5000-lb. steel double-circuit tower line. The cost of excavating was less, the cost of hauling more, and erection or assembly less.

The relative cost can be better understood by a transmission engineer by stating that the character of the country necessitated the assembly of the structure "in the air." Also, 40% of the excavation was in rock.

The service that can be expected from this type of construction in first analysis is limited to the life of the wood-steel joints. This can be safely set as 10 years with reasonable attention from operators. Further, as wood section fails it can be replaced by wood or steel without excessive construction costs or interruptions to service.

STOPPAGE AND LEAKS IN TRANSFORMER COOLING COILS.

From Paper on "Symposium of Operating Difficulties," Before Pacific Coast Section, A. I. E. E.

By Julian Adams,

Assistant Electrical Supt., Pacific Electric Railway Co.

In the substations of the Pacific Electric Railway system the transformers vary in size from 100-kv-a. to 1000-kv-a. and a large percentage of them are water cooled. With these substations scattered over a wide area, all sorts of water conditions are encountered. In localities where a large amount of solid matter is held in solution considerable trouble has been experienced with the transformer water coils becoming clogged with the solids deposited by the water on the interior of the coils. The presence of the deposit is indicated by a gradual decrease in the amount of water which will flow through the coils and as the amount of water is decreased the temperature is raised and the deposit of the solid matter becomes more rapid.

Our experience in cleaning these coils has indicated that the best method is to pump in a dilute solution of muriatic acid through them. For this purpose we make use of a 1½-in. all brass centrifugal pump. We start by pumping water through the coils and slowly add muriatic acid until a maximum strength of about 2 pints of acid to 10 gallons of water is used. It is often necessary to pump the acid through for several days before the coils are clean. If acid of the final strength mentioned is used to start with it is likely to result in stopping up the coils completely, and when this occurs it is sometimes impossible to clear the coils even with the use of high pressure. We had one case of this kind, and when the coils were cut open they were found to be solidly plugged with very dense iron oxide. In this case the water came from a deep well pump and examination showed that the pump casing in the well had been eaten away by electrolysis and the iron transferred to the interior of the transformer coils in the form of iron oxide. This of course was an unusual case.

Some of the older transformer coils were made of very thin brass tubing and after some years of service these coils gave a great deal of trouble due to leaks produced by local galvanic action set up through impure water by the dissimilar metals composing the brass. In a few cases leaks developed in these coils which allowed sufficient water to get into the transformer, before it was detected, to short the transformer windings. In more recent years copper has replaced brass for transformer coils and heavier tubing used, making more durable coils. While iron coils seem to be meeting with some favor, they are open to the objection that iron has much lower heat conductivity than copper, thus requiring greater coil area and weight for equal cooling effect, also a greater labor cost.

It is of course apparent that much of the trouble that developed with transformer water coils, both as to their becoming clogged and as to their leaking, could be avoided by the use of an effective purifying system for the water, but where a large number of substations are involved, as well as a large number of different kinds of water, the cost of an effective purifying system of water is considerable.

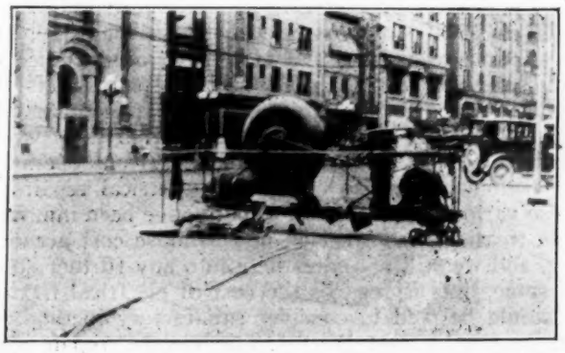
In the case of new installations the simplest and cheapest means of avoiding trouble with transformer water coils is not to use them. In sizes up to 1000-kv-a. self-cooled transformers now cost little if any more than water cooled transformers and when the cost of installing and maintaining a cooling water circulating system in connection with water cooled transformers is considered, together with the other costs incident thereto, it is my opinion that the use of water-cooled transformers is undesirable even in sizes much larger than 1000-kv-a.

PORTABLE BLOWER FOR COOLING OF OVER-HEATED DUCT SECTIONS.

Practice of Detroit Edison Co. for Overcoming "Hot Spots" in Underground Cables.

When a periodical temperature survey of an underground distributing system brings to light a particularly hot duct section of, say, 150° F. or more, some means must be adopted to dissipate the heat if trouble is to be avoided. This is accomplished in Detroit according to G. B. McCabe, in the *N. E. L. A. Bulletin* by the use of locally applied forced ventilation from a portable blower. The outfit consists of a blower of the upper right-hand horizontal-discharge type equipped with a 28-in. fan and directly connected to a 7.5-hp., 220-volt direct-current motor. The entire equipment is mounted on a steel truck.

When a particular hot duct run is discovered the



Portable Blower Outfit Employed by Dayton Power & Light Co. Answers Same Purpose as That of Detroit Edison Co.

blower outfit is hauled to the vicinity and mounted over the manhole at one end of the run. The discharge pipe from the blower is inserted in a circular sheet-iron plate of the same diameter as that of the manhole cover. The iron plate and the discharge pipe are then cemented in place with asbestos cement in order to make an air-tight joint. At the other end of the hot run a ventilating cover is placed which covers the manhole.

This cover consists of a number of 1-in. by 0.5-in. iron bars placed 0.75 in. apart and bound together by a circular band. Direct-current service at 250 volts is furnished to the blower motor from some nearby pole or wall box. The current of air is forced through the underground ducts until the temperature of the duct section affected has been reduced to the desired degree.

Contracting-Construction

Suggestions for Obtaining and Keeping Records of an Electrical Department—Effect of Lightning on Circuit Unexplained

RECORDS FOR AN ELECTRICAL REPAIR AND MAINTENANCE DEPARTMENT.

Methods for Gathering Records Advocated in Paper Presented Before Association of Iron and Steel Electrical Engineers.

By R. B. Gerhardt.

Inasmuch as the direct benefits derived from an accurate method of securing and keeping records and data in an electrical department are hard to capitalize, such systems should be elaborated with great caution else the benefits will not be commensurate with the expense involved. In a well organized and well regulated department the records of most value are:

(1) Cost records.
(2) Force reports.
(3) Foremen's and motor inspector's reports.
(4) Station and power distribution reports.
(5) Electrical repair shop production reports.
(6) Storehouse and material reports.
(7) Employes' records and accident reports.
(8) Generator, motor and transformer data.

Cost Records.

The electrical department may be considered a business in itself, and, as in any other business, the most vital records to the successful conductance of same are the cost records. In most plants it is the usual practice for the accounting department to take care of all cost accounting entering into the cost of electrical energy to be billed to the various operating departments and also of cost of electrical repairs to these various departments. There have been innumerable treatises published on power-house cost accounting, and we will not enter here into any further study of same, but, as regards the cost of electrical repairs, it would be well to consider satisfactory methods of arriving at a cost price. The electric repair shop can usually be operated as any other standard shop account and all work going through same should bear a definite order number and proper accounting done to give the cost on this order when the work is completed. However, in the smaller plants this would involve considerable expense, and it is often the practice to distribute the cost of the electric repair shop operations on a basis of the labor distribution in this shop, this labor being accounted for daily according to the number of hours worked on repairs for any of the plant departments.

The shop costs will consist of labor, material and overhead. The overhead is approximate at best, but should be determined monthly as a percentage on the labor by dividing the cost of all items, such as foreman, clerk, telephone, light, heat, power, etc., by the total cost of all producing labor. This figure can be determined readily by the accounting department.

Every shop, no matter how small, should have a job ticket system. This would consist of a number of serially numbered tags, either in duplicate, or single tags with corresponding numbers in a record book. This tag can be an ordinary small shipping tag and should take a form similar to that shown in Fig. 1. If difficulty is encountered in some places in establishing the material charge, such odds and ends as tape, solder, etc., which nearly every worker carries on his bench, can be carried in the overhead without destroying the value of the record. This card should be turned into the shop office after the work has been accepted as complete. It should then be routed to the person maintaining the apparatus record, who will take off the total repair charge on the record card for this particular piece of apparatus. This gives a fair value to the job, enables the shop production to be recorded and gives the superintendent immediate data on the maintenance cost of the apparatus.

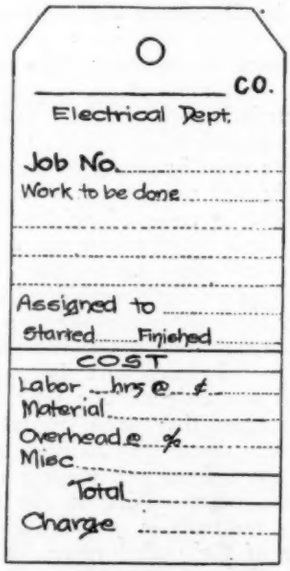


Fig. 1.

It is often desirable to secure an accurate cost figure on a particular armature or motor or controller to be repaired, and in such cases a good practice is to have the accounting department assign a special charge, such as a repair and renewal order, for this job, in which case when the work is completed they can furnish an itemized cost of same.

Force Reports.

An accurate daily report of the electrical department force distribution is essential to the proper handling of the department, and usually a copy of this report is requested by the management, principally as a guide to determine whether the department is being handled efficiently or not. The force report should be divided up according to departments in the plant, showing under each department the number of foremen, assistants, motor inspectors, electricians, re-

pairmen, helpers and any others. To obtain the force report an efficient and inexpensive method usually employed is to have each foreman or motor inspector

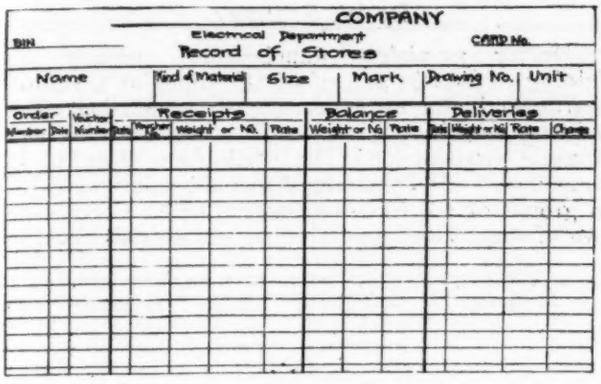


Fig. 2.

in charge of a shift in each department make out a time distribution sheet for his men, to be collected by the department timekeeper on his daily round of the plant, said timekeeper compiling the figures for the final report when he returns to the office each morning.

Foremen's and Motor Inspectors' Reports.

Along with the force report made out each shift by the foremen and motor inspectors should go a condensed written report of the important work taken care of during the shift, this report to indicate any delays due to electrical failures, results of inspections, explanation of remedies for delays and principal work done other than this. Such reports, together with cost records and force reports, give complete data on the electrical repairs in any department.

From the practice of having foremen and motor inspectors turn in daily reports there sometimes results a tendency on the part of these men to elaborate too much in these reports and give too much detail, or the reverse, be too brief and not give sufficient information. One fundamental point, however, should always be insisted upon, i. e., a statement of the plant delays chargeable to the electrical department, with an explanation of these delays and remedies for same, the foremen's or motor inspectors' signature to be written below this statement. When this is insisted upon and the man given to understand by the department superintendent his full responsibilities for an accurate check between this report and the plant delay sheet, the desired end is usually accomplished, viz., that proper co-operation is secured in keeping down such delays.

Station and Power Distribution Reports.

It is becoming more and more the practice in industrial plants to secure, as far as possible, an accurate distribution of electrical energy to the various departments, and, therefore, the electrical department station records are invaluable for this purpose. A station report is usually a printed form giving space to record all energy distribution data, according to the outgoing feeders. When such a station has an operator in continual attendance it is a wise policy to have all distribution meters read hourly, as this keeps the operator's attention more closely applied to his work and prevents his falling asleep at night.

In many of the departments in which energy-metering instruments are lacking it becomes necessary, in order to secure proper distribution of power, to make tests under normal conditions of load for the purpose of securing a basis for making a charge for this energy, and at the end of each month the energy consumption is figured out on the basis of such tests. Likewise at the end of the month the final power distribution report is made up in the department office, which gives an accurate statement of the energy furnished to all accounts properly chargeable, and this statement is the accounting department's basis of distributing the cost of producing this energy.

Electric Repair Shop Production Reports.

Under cost records we have considered electric repair shop production costs, but there is still further information from the shop which is essential to the good management of same, and this is production data. In other words, how many armatures of a certain type are rewound in a given period; the average number of man-hours for rewinding these armatures; an accurate record of the armature serial numbers; a short condensed statement of the work involved in the repairs, and similar information for motors, controllers, transformers, etc.

On these records a great deal or a very small amount of effort may be expended. One very good method of keeping data on armature repairs is to have each armature winder make out in duplicate, one copy to be kept by himself, and the original turned in to the office, a record which will serve more as a diary, and which gives the information referred to above. It is very desirable and satisfactory for the department superintendent to know when an armature goes out on a breakdown job and fails without apparent reason, and by referring to the armature winder's daily diary the responsibility for poor workmanship in the case of such failure is easily determined.

Storehouse and Material Reports.

There is probably more miscellaneous material carried in the storehouse for the use of the electrical

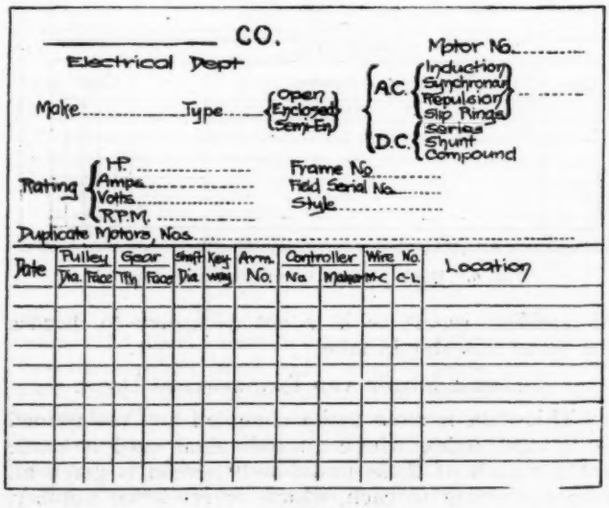


Fig. 3.

department than any other department in an industrial plant, and an accurate and reliable storehouse record on this material is absolutely essential. Any material used in the department is first obtained by placing a requisition to cover an order for the purchase of same. For keeping a proper record of this material a card index scheme is usually used. Each item of

material is carried on a card as shown in Fig. 2, and properly indexed, each card bearing a number. This card should contain the following information: Requisition and order numbers for each receipt of this material, date of receipt in warehouse, voucher number, unit cost, weight and kind of material. The card should also contain a column for balance and deliveries. By working this scheme in connection with a bin system in the storehouse, the material records can easily be kept and a satisfactory check made at any time with very little expense. It is usually the custom to set a minimum amount or number of each piece of material to be carried in stock, and whenever the storekeeper sends to the bin to take out material it can be easily noted whether the minimum amount still remains, and if not a note made and requisition placed for additional amounts in order to replenish the stock.

Employes' Records and Accident Reports.

A record of department employes showing the date of employment, check number, work or job to which assigned, any further changes of assignment, rate, change of rate, and termination is very essential to the proper management thereof. This record, however, should be kept confidential and where it is not available for everyone's use.

Department accident reports are so closely connected with employes' records that it has been found desirable to keep these two forms of records together. A copy, however, of the accident reports is also maintained for the use of the department safety committee in its work. Each plant usually has its special form

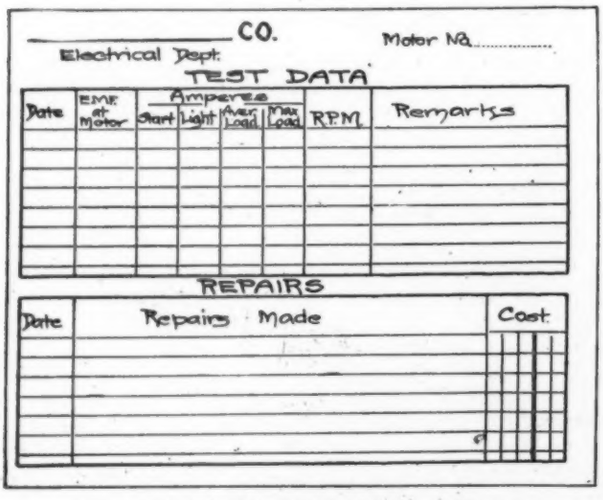


Fig. 4. Back Side of Form Shown in Fig. 3.

of accident report so it is not necessary to discuss the form this should take.

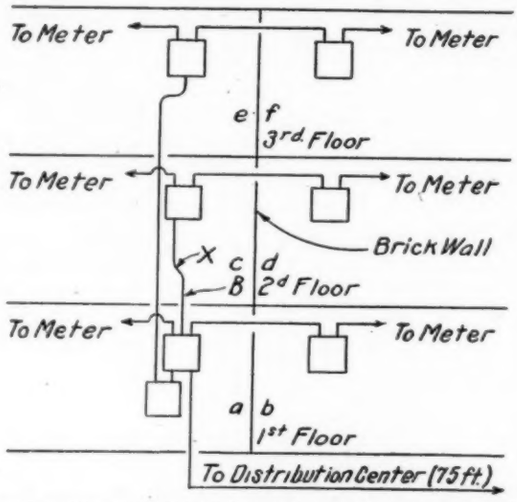
General Motor and Transformer Data.

This data is most easily compiled and maintained on a card index where an individual card is made out for each of these units, and thereon is given all data pertaining to each, which covers serial number, nameplate data, principal dimensions, including, in the case of generators and motors, size of shaft, keyway, pulley or gearing data, all particulars regarding windings, brush size, etc. A sample motor card is shown in Figs. 3 and 4. The motor data cards should be indexed according to departments and a cross index kept showing the motors by size and type, and in this way a complete record of the total number of motors of each size and type is readily available.

PECULIAR EFFECT OF LIGHTNING ON A DISTRIBUTION CIRCUIT.

By W. F. Perry.

During a violent thunderstorm recently the lighting circuits in several of the suites of a Boston apartment house were put out of commission. The building contained 36 suites and was of brick and concrete construction. The wiring was installed in conduit and was so arranged that the suites were fed in groups of six from a two-wire main. There were two of these suites on each floor. In a small closet in



Wiring Diagram Showing Location of Circuits and Fault.

each suite were placed the service cutouts and the meter. There were no other cutouts, the number of outlets being small, the service cutouts protected the wiring system as well as the meter. The feeder which supplied current to these suites was No. 12 rubber-covered duplex wire. The service supplying the building was of the three-wire type and entered the building underground.

While the storm was in progress the fuses which protected the feeder blew out, as did the service fuses in the two lower suites. A trouble man from the central-station company was called and replaced the blown fuses, but he could get no current in the four upper suites. An electrician was called and he spent several days in search of the trouble without finding the cause. Later, the writer was called upon to solve the problem.

Several hours were spent in getting "the lay of the land" and in working out various tests upon the defective lighting circuits. A sketch was made, showing how the runs of conduit were made and how the several lines of wire were connected at the junction boxes. The accompanying illustration gives an idea how the conduit was run between boxes.

The trouble was found in the riser *B* at the point marked *X*. About ¾ in. of the outer braid of the No. 12 duplex was blown off and a piece ⅜ in. long of one side of the circuit, including wire, rubber and braid, was missing, the remaining ends looking as if the piece had been cut out with a knife. There was nothing to indicate the presence of fire, as the rubber and braid were not charred.

[Editor's Note.—The peculiar effect of lightning in this case seems unexplainable. If some of our readers have had similar experiences their comments would be welcomed.]

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

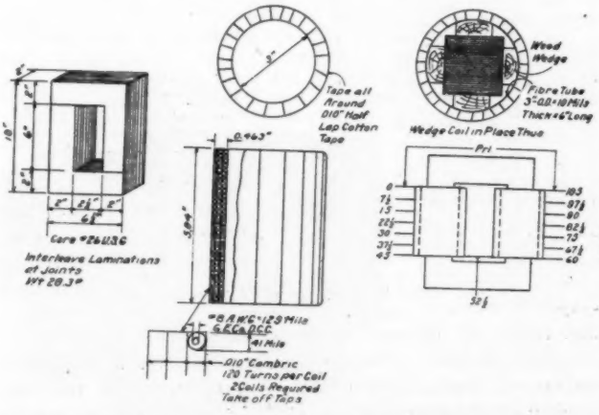
No. 473.—Changing Motor Frequency.—I would like information regarding changing of a ⅛-hp. Holtzer-Cabot single-phase motor of 1130 r. p. m. and 12 poles now operating on 133 cycles to make it possible to operate on 60 cycles at a speed of 1200 to 1300 r. p. m.—M. B., Dekalb, Ill.

No. 474.—Inferior Wire for Fixtures.—In my experience I have often run across fixtures wired with old Code wire and with No. 20 and even No. 22 low-voltage wire. I understand that considerable quantities of these wires are being used. What can be done by a contractor who wants to live up to Rule 30*c* of the National Electrical Code to meet the competition of those who ignore this rule?—B. T. F., Morgan Park, Ill.

Answers.

No. 464.—Transformer Design.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

Answer A.—The attached sketches illustrate an autotransformer capable of doing what W. A. S. wishes without being as expensive as a transformer with isolated primary and secondary would be. This transformer will operate on 100 to 120 volts, 60-cycle alternating current. As many taps as desired may be brought out. The case may be 6 by 10 ins. by 12 ins. high. A cover must be provided. Place the terminal



No. 464.—Design of Autotransformer with Numerous Taps.

board on top. For method of clamping laminations, see "Gray's Electrical Machine Design" or similar work.—H. E. W., Chicago, Ill.

Answer B.—Owing to the fact that no data are given concerning the operating characteristics of the transformer in question it is difficult to supply figures which will exactly suit the builder's purpose. The following data may be of some value:

Core area, square inches	9
Number of turns on primary	412
Size of primary conductor, B. & S.	14
Number of turns per layer—primary (approximate)	69
Number of layers—primary	6
Volts per turn	0.26
Length of primary conductor, ft.	370
Number of turns on secondary	395
Size of secondary conductor, B. & S.	14
Number of turns per layer—secondary	69
Number of layers—secondary	6
Length of secondary conductor, ft.	362

Secondary taps brought out as follows:

7.5 v.	= 28 turns	45 v.	= 168 turns	82.5 v.	= 308 turns
15	= 56 turns	52.5	= 196 turns	90	= 336 turns
22.5	= 84 turns	60	= 224 turns	97.5	= 364 turns
30	= 112 turns	67.5	= 252 turns	105	= 392 turns
37.5	= 140 turns	75	= 280 turns		

—W. F. P., Atlantic, Mass.

No. 471.—Ringlemann Charts for Determining Smoke Density.—The use of Ringlemann charts is frequently mentioned in connection with the determination of the density of smoke emitted from smokestacks. I would much appreciate an explanation of what the Ringlemann chart actually is and how the density of smoke may be determined from its use.—M. A. P., Spokane, Wash.

Answer A.—Ringlemann charts, named after their originator, are used for determining readily the density of smoke. The density of smoke is at best somewhat elusive and hardly permits of a definite basis for comparison. However, there are a number of "standards" employed, one of the best known and simplest of which is by the use of the Ringlemann charts. These charts are quite generally accepted as the standard today.

There are six Ringlemann charts, numbered respectively from No. 0 to No. 5. Chart No. 0 is white and is rated as being 100% white or zero black. No. 1 chart is rated as 80% white or 20% black; No. 2 as 60% white or 40% black; No. 3 as 40% white and 60% black; No. 4 as 20% white or 80% black, and chart No. 5 as 0% white and therefore 100% black. The Ringlemann charts or cards are made by ruling lines at regular intervals; the higher the number of the card the thicker and closer are the lines, consequently the card looks more or less gray at a distance.

In using the Ringlemann charts, they should be placed vertically at such a distance from the person that is to determine the smoke density that any of the charts appear to be of a uniform shade of coloring. That is to say, the checks must not be visible, but instead the cards should appear of different shades from the absolute black to the slightly dark, according to the card placed in position. The person observing the smoke should stand not less than 100 ft. nor more than one-quarter of a mile away from the stack. The observer's position should be such that the direction of his observation is at right angles to the direction of travel of the smoke. He should avoid looking in the direction of bright sunshine, and the background against which the smoke is to be studied should be free from trees, buildings and similar objects that tend to harmonize with the smoke.

Compare the smoke emitted from the stack with the Ringlemann charts, and determine which of the cards corresponds to the color of the smoke. The period for deciding the chart corresponding to the

smoke is usually taken as 15 seconds. The color of the smoke may change frequently, and the observer should write down on paper at every 15-second interval the chart number corresponding to the color of the smoke.

How long a stack should be watched, depends upon how much time can be devoted to the matter, to what extent the stack is given to emitting smoke, and whether the effluent from the stack changes very radically in color from time to time. For example, a hand-fired plant may emit dense clouds of smoke periodically corresponding to the act of throwing coal on the fire, whereas a plant using mechanical stokers will give a very much more uniform density of smoke, because in the one case firing is erratic and in the other case continuous. Half an hour should probably suffice under most conditions.

A few definitions of terms, and a simple example in the use of the Ringlemann charts will suffice to make their use understood.

(1) A stack-minute corresponds to watching the stack under scrutiny for one minute.

(2) In any set of observations the stack-minutes are obtained by multiplying the number of stacks observed by the number of minutes during which the observations are performed.

(3) A smoke unit is understood to be that value during which one minute of No. 1 smoke or its equivalent occurs. For example, one minute of No. 2 smoke (which means a smoke density corresponding to chart No. 2) is equivalent to two smoke units. Likewise, two minutes during which the smoke has a density corresponding to No. 3 chart would give a smoke unit of six, or six smoke units. Three minutes of No. 4 chart would correspond to 12 smoke units.

The percentage of smoke density is percentage of light that is prevented from passing over the stack because of the smoke. The smoke density is calculated as follows:

$$\text{Percentage smoke density} = \frac{\text{Smoke units} \times 0.20 \times 100}{\text{Stack-minutes.}}$$

$$\text{This when simplified gives} \frac{\text{Smoke units} \times 20}{\text{Stack-minutes.}}$$

Understanding what the Ringlemann charts are, what they represent and how a smoke unit is determined, an example in the use of these charts for an actual smoke inspection should clear up any misunderstandings and place the matter upon a proper basis for future application.

During one hour a stack was watched and its smoke compared with Ringlemann charts with the following results recorded:

Smoke density according to Ringlemann chart.	Duration of smoking minutes.
No. 4	2
No. 5	1½
No. 3	3⅓
No. 2	10
No. 1	9
Clear	34

Smoke units are the product of chart number and duration corresponding to this number. Hence,

$$\begin{aligned} 4 \times 2 &= 8 \\ 5 \times 1\tfrac{1}{2} &= 7\tfrac{1}{2} \\ 3 \times 3\tfrac{1}{2} &= 10\tfrac{1}{2} \\ 2 \times 10 &= 20 \\ 1 \times 9 &= 9 \\ \hline & 55 \text{ total smoke units.} \end{aligned}$$

Therefore, according to formula previously given,

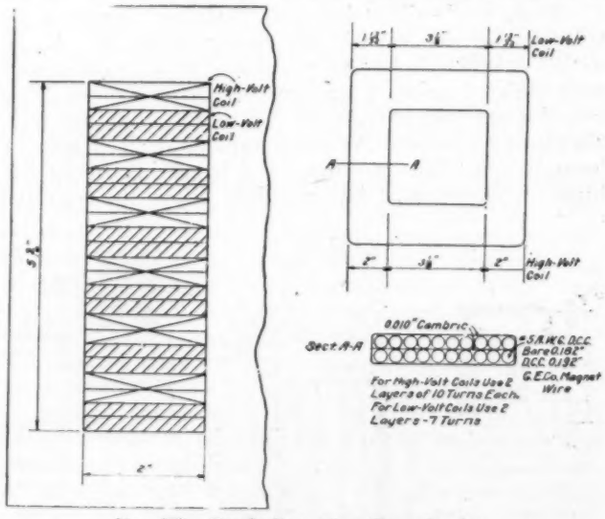
$$\text{Percentage smoke density} = \frac{55 \times 20}{60} = 18\% \text{ (approx.).}$$

In observing smoke densities, it is a good thing to use cross-section paper in a notebook. Each entry is made as shown above and each step toward the result should be kept when observations are made for civic purposes. When observations are being made merely for personal reasons, it is well for the firemen to keep a close and accurate log of boiler-room operations, as in this way much may be learned in the way of smoke abatement.—W. H. D. M., Chicago, Ill.

[Another answer to this question has been submittded by another reader. It will appear in an early issue.]

No. 472.—Rewinding a Transformer.—I have the complete core and case of a 2½-kw., type H, 60-cycle G. E. transformer which I would like to rewind for the ratio of 88-176-volt primary and 115-230-volt secondary of about 2 kw. capacity. The inner core is 3 by 3 ins., extending over the outside of the coil in four equal sections of 2½ by 1¼ ins. cross-section, leaving a winding space around the core of 2 by 5¾ ins. The original voltage ratio was 1200-2400 primary and 120-240 secondary. The use of this transformer is to be for intermittent service only of about 2 to 3 hours' duration, for demonstration of fractional-horsepower alternating-current motors. Please advise what size of wire and number of turns to use on primary and secondary windings. Would it have to be oil-cooled like the original? Would a 3-hp. direct-current motor, old style G. E., wound with two No. 14 B. & S. wires in parallel, wave-connected, running as converter on 115-volt direct-current line, be sufficient for this purpose or would it be necessary to decrease the capacity of the transformer to suit the converter? The present alternating-current voltage obtainable at the converter averages 88 volts, 60 cycles, single phase.—V. S., Portland, Ore.

The sketch herewith shows one of the many possible methods for solving the problem. The view at the left shows the layout of the coils and the view to



No. 472.—Rewinding of a Transformer.

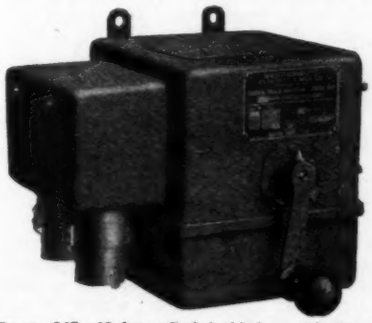
the right the dimension of the coils and method for their insulation. These coils can best be wound on a form and then slipped out. The quantity of material can be easily taken off by calculation from the sketch. With this arrangement a single size of wire is used and no oil is needed to load up the transformer for 2-kv-a. intermittent use. Sufficient data are not given for an intelligent answer to the second question, but I believe the converter can be made to carry a 2-kv-a. load under the conditions stated. I would suggest keeping a thermometer on the machine for the trial run.—H. E. W., Chicago, Ill.

New Appliances

Safety Inclosed Starting Switch—Hubbell Devices—Series-Parallel Controller—Light Plant—New Turbine Governor

Westinghouse Safety Inclosed Motor-Starting Switch.

Safety for the operator, safety for the motor and equipment, and safety for itself are the three features embodied in a new type of starting switch for small induction motors that is being put

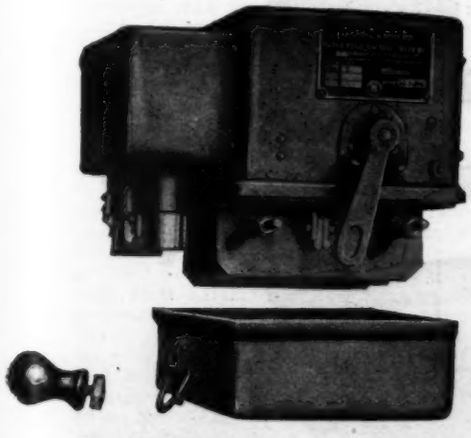


Type 815 10-hp. Quick-Make-and-Break Starting Switch.

on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The switch is said to be absolutely accidentproof and well nigh foolproof as well.

The action of the switch is automatic and involves use of strong springs attached to the contact parts and controlled by a trigger. This trigger is released by overload, failure of power or by hand. When the switch passes the neutral point, the spring snaps it the rest of the way.

Safety to the operator from injury due to contact with live parts is assured by the entirely inclosed, dust-and-dirt-proof case. It is impossible to touch the live parts by accident for this reason. Safety to the operator and equipment from restarting after the machine has shut down is assured thus. When



Type 815 Quick-Make-and-Break Starting Switch with Tank and Arc Barrier Removed to Show Position of Contacts.

power leaves the equipment a low-voltage protective relay releases the trigger and throws the switch. Upon the return of power it is necessary for the operator to move the handle first to the reset position and then to the running position before the motor can again be started.

Any undue overload causes the overload relay to release a trigger which opens the switch the same as on failure of voltage. Overload throws off the switch just the same as power and the switch must be reset before the motor can again be started. This overload relay prevents burnout of the motor. Motor burnouts may arise from two causes—an overloaded machine or the opening of one wire, due to the blowing of a fuse or other cause and subjecting the remaining phases to an extra burden. The overload relay may be set to open the switch at any desired point, such as 100-110-150% of full load. Fuse protection is not sufficient to guard motors against burnout. A fuse that, without blowing, will carry the starting current, which is several times the operating current, will also carry without blowing sufficient overload to burn out the motor. The overload relay is provided with oil dashpots which afford a time-element protection, permitting the carrying of small peak loads and the starting current without interruption of service. However, they will allow the operation of the overload relay if the overload is heavy or is sustained long enough to threaten the motor. This insures the motor against burnout and at the same time permits maximum production.

Replacing burned-out fuses with copper wire when new fuses are not available results in a burned-out motor the next time an overload occurs. This danger is eliminated because the new switch uses no fuses and automatically resets itself when the overload is removed. Besides this, the danger of shocks and burns in replacing fuses is eliminated.

When the handle of the switch, moving toward the "on" position, passes the neutral point, the spring whips the contacts together. The same action takes place with the opening of the switch. This rapid opening and closing of the contacts practically eliminates the injurious effects of arcing and preserves the life of the switch.

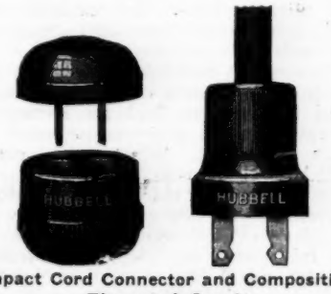
Asbestos barriers between the sets of adjacent contacts have permitted the omission of switch oil with all its accompanying fire hazards and other objectionable features. But when explosive gases are present and the danger of explosion is greater than the fire hazard, the contacts may be immersed in oil. Emergency-stop push buttons may be connected in the low-voltage relay circuit and located at any convenient point near the machine.

This switch has been approved by the National Board of Fire Underwriters. Two sizes are made, each for use on two and three-phase motors, on voltages up to 600. Type No. 815 starts motors of 10 hp. or less while Type No. 816 starts motors up to and including 25 hp.

New Hubbell Cord Connector and Cap.

Harvey Hubbell, Inc., Bridgeport, Conn., has recently added two new devices to its extensive line of electrical specialties, namely, the No. 6180 cord connector and No. 6337 elongated cap. The former measures only 1⅝ ins. over all and is of exceptionally neat design. Although so small it is sturdy enough for use with any appliance where a cord connector of 660-watt, 250-volt capacity is desired.

The elongated cap is made of composition throughout. While similar in appearance to this firm's No. 6336 cap,



Compact Cord Connector and Composition Elongated Cap.

this new one has a half-inch cord hole for No. 14 and 16 reinforced cord.

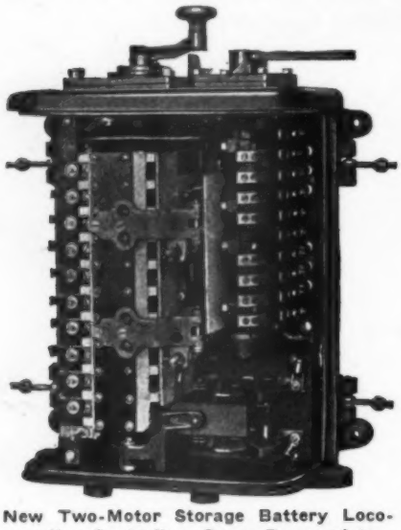
Drum Controller for Series-Parallel Operation of Locomotive Motors.

A drum type controller for series-parallel control of two series motors is one of the new products of the Cutler-Hammer Manufacturing Co., of Milwaukee, Wis. This controller, which is provided with both a main cylinder and a reverse cylinder, is for use on storage-battery locomotives or on trolley locomotives using 250 volts or less.

The motors are accelerated by the main cylinder, which has seven points of control. A star wheel provides an interrupted motion to the lever, so the operator readily feels the speed points. The fourth point is the full series or low-speed running point and the seventh the full parallel or high-speed running point. All intermediate points are resistance points. The Wheatstone bridge method is used for transition from motors in series to motors in parallel between the fourth and fifth points of control, and as the circuit is not opened, continuous torque is ob-

tained during the transition. Arc barriers are provided between each contact finger, and strong magnetic blowouts prevent excessive arcing.

The reverse cylinder is positively interlocked with the main cylinder so it cannot be operated when the latter is in any but the "off" position. The fingers of the reverse cylinder are therefore not used for making or breaking



New Two-Motor Storage Battery Locomotive Controller—Cover Removed to Show the Two-Cylinders.

the current; hence the contact parts will last indefinitely and magnetic blowouts are unnecessary.

Two cutout switches allow either motor to be by-passed, if it becomes damaged in any way, and the locomotive operated by the other motor until repairs are made. When one cutout switch is thrown to by-pass its corresponding motor, mechanical interlocks prevent closing the other cutout switch or operating the main cylinder beyond its full series position, thus eliminating the possibility of a short-circuit.

A dust-tight and weatherproof construction is obtained by fitting the sheet-metal cover under a ledge in the top and providing a rubber gasket between the edges of the cover and the cast-iron frame.

This new controller has the following features of construction common to other C-H drum controllers: Cast-iron sections of cylinder clamped on square insulated shaft, using no keys or taper pins, thus making removal easy; cylinders readily removed from case by merely taking off top plates; steel contact fingers of main cylinder mounted on square insulated metal shaft, which can be removed by taking out two cap screws; all fingers provided with drop-forged copper tips of the nonstubbing type.

The contact fingers and segments may be adjusted or renewed without removing the cylinders from the drum case. Those on the reverse cylinder are exposed by merely loosening two thumb nuts and throwing back the blowout plate and arc barriers.

Most mine-duty apparatus is employed where the service conditions are severe and delays in operation costly, consequently this new controller has its parts very liberally proportioned to prevent wear and breakage, and those parts which do wear are made accessible and easily renewable.

Buda-Ross Steam-Turbine Electric Light Plants for Construction Projects, Etc.

There are many cases of construction projects where the contractor has a steam boiler for supplying hoisting engines, pumps, compressor sets, etc., and where light is also needed. A steam-driven lighting plant could be of special service in such cases. In many cases small isolated sawmills, oil-well-drilling outfits, cotton gins, steam shovels, small steamboats, etc., could use a similar outfit.

The Buda Co., Chicago, Ill., began manufacturing small steam turbogenerators for locomotive headlight service about six years ago. The use of the small steam turbogenerator has grown in many industries and the demand for this kind of a lighting plant has grown to such an extent that the manufacturers have made some recent improvements in it, enlarged the facilities for production, and will market it generally through dealers as one of the main line of Buda products.

This practically new plant is known as the Buda-Ross electric light plant. It is an unusually small one for a steam turbogenerator plant, the smaller size having a capacity of ½ kw. and the larger size 1 kw., making it adaptable for lighting small plants and portable outfits.

The steam turbine and the electric generator are built compactly into one direct-connected unit. The field coils of the generator have a compound winding which keeps the voltage uniform on any lamp load ranging from zero to the full capacity of the plant. This makes the operation of the lighting plant entirely automatic, requiring no other attention than turning on the steam when the lights are needed and turning off the steam when lights are no longer needed. The generator is of the bipolar type and wound either for 32 volts or 110 volts direct current as desired.

As with the headlight plants, the turbine for the new plant is of the mulistage, radial-flow, impulse type. Its speed is kept uniform, regardless of fluctuations in steam pressure within the range of 85 to 200 lbs., and regardless of the electrical load within the range of from zero to full capacity, by a centrifugal, throttling type of governor which admits only enough steam at the primary nozzle to run the turbine at the speed required.

Westinghouse Marine Turbine Governors Keep Speed of Vessel Uniform.

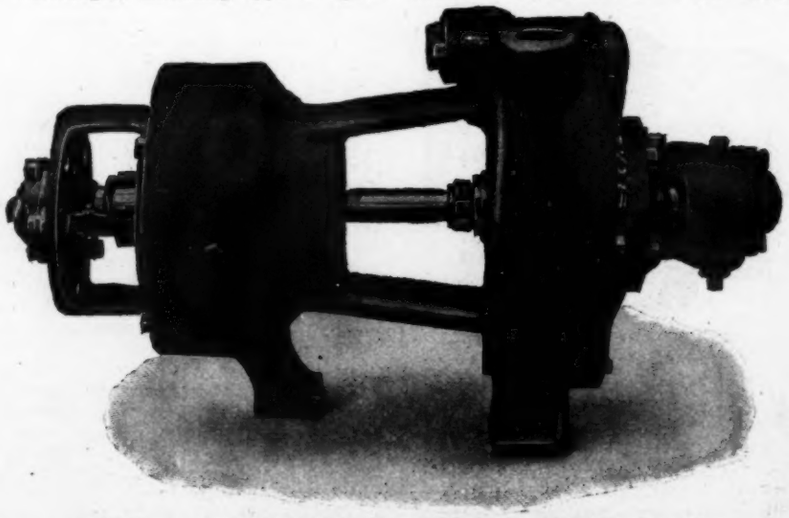
To guard against racing the majority of marine-turbine builders install on their machines an automatic tripping device, which is set to shut off all steam to the turbine when the speed reaches a limiting point of, say, 10% or 15% above normal. This stops the turbine entirely and in order to start up again the trip must be reset and the steam valve opened.

All marine turbines made by the Westinghouse Electric & Manufacturing Co. are fitted with governors which under no circumstances will shut the turbines down completely, but which will regulate the flow of steam to the nozzles in such a manner that the speed is kept practically constant under all conditions of fair and rolling seas.

The arrangement consists of a vertical spindle mounted on the forward end of the turbine, driven by a worm wheel from the main shaft at a speed of about one-quarter of that of the main shaft. At the top of this spindle is mounted a fly-ball governor of the familiar type, the motion of which is transmitted through a system of levers to a small steam relay piston valve, which in turn regulates the flow of steam to the operating cylinder of the main governor valve.

As the speed of the turbine increases above normal, the governor weights are thrown farther away from their center of rotation by centrifugal force and the steam relay valve is moved a corresponding amount. This opens up the steam ports which exhaust the steam from the bottom of the governor valve-operating cylinder, producing an unbalanced condition, and the governor valve starts to close, slowing down the turbine. But as soon as the speed is reduced to normal the governor weights return to their former position, moving back the relay and reopening the governor valve.

While no attempt is made to obtain extremely close regulation, such as is needed on electric generator drives, it has been found that the marine governors are very positive in their action.



Buda-Ross Steam-Turbine Electric Light Plant of 1 Kw. Capacity.

Trade Activities

Organization of Booth Electric Furnace Company—Domestic Engineering Taken Over by General Motors—Catalogs

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is sending out a new price list on electric ranges and bayonet immersion type liquid heaters, effective Sept. 10.

Remmert Manufacturing Co., St. Louis, Mo., of which William Remmert is the organizer, was recently awarded a basic patent on its Locomotive washer. Mr. Remmert is a well known designer and an expert in washing machine construction, and his experience covers practically every make of washer. About three years ago he conceived the idea of a machine which would eliminate the mechanical appliances and rubbing devices which come in contact with the clothes while they are being washed. This he claims is accomplished in the Locomotive washer in which the clothes receptacle contains no moving parts, the possibility of tearing clothes thus being eliminated. To provide the necessary water agitation the entire receptacle or tub is moved horizontally over a runway by means of reducing gears and an eccentric. In this way the water is forced through the fabric, cleansing it thoroughly and quickly. The machine is very compact and substantially built with all moving parts inclosed.

Domestic Engineering Co., Dayton, Ohio, manufacturer of the Delco light and power plant for use on farms, and in isolated public buildings, will be taken over by the General Motors Co. It is reported that the acquisition of the Domestic company involves millions of dollars, and through the deal Dayton will benefit immensely as expansion plans will be prosecuted on a gigantic scale. Though the Domestic company was incorporated only three years ago with a capital of $800,000, the development of its business was so rapid that the capitalization was increased to $1,500,000. During the three years of its existence the company has manufactured 100,000 lighting plants, and the product has been shipped to Australia, England, France, South America, China, Japan and other foreign countries. An enlargement of the foreign trade will be one of the earliest developments under the new consolidation plans. The Domestic Engineering Co. now employs a force of 2000 persons in office and factory and 3500 salesmen whose territory embraces all sections of the United States and the world. It has been reported also that accessories manufactured by the company assure a volume of business reaching $3,000,000 annually. The plant now occupies 340,000 sq. ft. of space and new buildings are under course of construction.

Eureka Vacuum Cleaner Co., Detroit, Mich., is distributing a new folder to the trade, containing various sales helps for the dealer of the Eureka vacuum cleaner. There is a particularly fruitful field for this labor-saving device, and dealers should avail themselves of the opportunities afforded to promote the sale of this product by linking their sales efforts with the national advertising campaign which is being conducted by the company. The folder contains full-page reproductions of forceful advertisements appearing in the *Saturday Evening Post, Good Housekeeping, Ladies' Home Journal* and other mediums. In addition, it includes a series of newspaper advertisements, providing space for the name and address of the dealer. These have been prepared especially for the dealer for use in local papers, and electrotypes of the "ads" are furnished by the company. As a part of its sales and promotion and advertising campaign, a great variety of attractive window cards, hangers, folders and booklets are also offered by the Eureka company.

Important Change in Booth-Hall Management. — Announcement is made of the organization in Chicago of a new corporation under the laws of the state of Illinois known as the Booth Electric Furnace Co., with paid up capital of $1,000,000. Of this amount one-half is preferred stock, and one-half common. The new company has acquired all the patents, assets, and good-will of the Booth-Hall Co., well known as a manufacturer of electric steel and brass melting furnaces, and has taken over the business formerly carried on by that company. It will greatly enlarge the scope of operations, and develop the electric furnace business along standard manufacturing lines rather than on a special engineering contracting basis. The Booth rotating furnace which has been in successful operation during the last six months, and which is especially designed for the melting of non-ferrous metals, has been thoroughly developed and standardized, and the company is prepared to deliver this type of furnace in four sizes, viz., 250-lb., 500-lb., 1000-lb., and 2000-lb. equipments. The well-known 2-phase, 2-electrode Booth-Hall furnace for the melting of iron and steel will also be made in five sizes, namely, ¾-ton, 1½-ton, 3-ton, 6-ton, and 12-ton. An improved type of furnace, oval in shape, has been designed, and prompt shipment can be made of any one of these five sizes.

The new company will have exceptional manufacturing facilities for turning out furnaces in quantities. Not only have all parts been standardized, but each furnace will be assembled complete before shipment, and thoroughly tested out to absolutely insure mechanical and operating perfection. Associated in the management of the company will be a number of the best known engineering and operating executives in the public service field. L. E. Myers, of Chicago, president of the L. E. Myers Co., has been elected president of the new corporation; C. H. Booth, formerly president of the Booth-Hall Co., vice-president; W. K. Booth, formerly chief engineer of Booth-Hall Co., secretary; and L. J. Clark, of the L. E. Myers Co., treasurer. In addition to the president, vice-president and secretary, the board of directors will include Martin J. Insull, vice-president of the Middle West Utilities Co., and E. W. Lloyd, of the Commonwealth Edison Co., both of Chicago. The new company is prepared to carry on an aggressive campaign for business, and will open sales offices in different parts of the country to properly handle its business. An adequate engineering staff will be maintained to co-operate with customers in connection with their electrometallurgical problems, especially those relating to the melting of metals.

Edison Electric Appliance Co., 5660 West Taylor street, Chicago, is distributing a new catalog of lamp socket appliances and heavy duty equipment. It comprises some 25 pages and contains brief and comprehensive descriptions at Hotpoint appliances accompanied by illustrations. In this publication is introduced a new line of beautiful silverware which is doubtless one of the highest developments of the art of electric hollow-ware. This ware is the celebrated 1847 Rogers Brothers, Adam Period design, and is so constructed that lifetime service is insured.

The new coffee percolators of this line, as well as other coffee percolators manufactured by the company, are equipped with a safety switch, which is a feature worthy of consideration. Increases in voltage and the fact that electric percolators were allowed to "go dry" while current was still on, resulted in burnouts of heating and damage to percolators. To solve this difficulty the engineering department of the Edison Electric Appliance Co. has brought forth a safety switch, which may be put into service again after an accidental overheating has caused the circuit to be opened, and is claimed to prevent burnouts and damage to appliance. It operates equally well on either direct or alternating current and is placed in the bottom of the percolator, being covered with the base plate.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Westminster, Vt.—Abenaquet Machine Works will erect a one-story shop, 150x500 ft., to cost $200,000.

Cambridge, Mass.—New England Telephone Co., 50 Oliver street, Boston, has commenced the construction of a new two-story addition to its local telephone building. The structure will be about 35x35 ft., and is estimated to cost $70,000.

Cambridge, Mass. — Cambridge Electric Light Co., Western avenue, has awarded a contract to Walsh Brothers, 150 Hampshire street, for the construction of its proposed transformer building on Western avenue. The structure is estimated to cost $10,000. French & Hubbard, 88 Pearl street, Boston, are engineers for the company.

Lynn, Mass.—Davis Lynn Storage Battery Co., Commercial street, has recently broken ground for the construction of a new one-story addition to its plant, about 50x200 ft. The structure is estimated to cost $35,000. Edward D. Dearborn, 24 Elm street, Lynn, is the building contractor.

Worcester, Mass.—Worcester Brass & Electro Plating Co. has purchased the factory of Oliver M. Dean & Sons, 316 Shrewsbury street, for $27,000 and will move there.

Providence, R. I.—H. H. Electric Storage Battery Co. has filed notice of organization to operate at 506 Broad street. Edward Hacking, 954 Lonsdale avenue, Central Falls, heads the company.

Woonsocket, R. I.—Arthur Dauray, Jr., 186 Harrison avenue, has filed notice of the organization of the Electric Maintenance & Engineering Works, to operate a general electrical contracting and repair establishment at 143-45 Railroad street.

Albany, N. Y.—Hunt, Helm & Ferris are having plans prepared for a factory and storage building.

Auburn, N. Y.—Auburn Button Works, 48 Canoga street, has filed plans for the construction of a new one-story boiler plant and engine house at its works. Contract for the structure, which is estimated to cost about $10,000, has been awarded to William Ludke, 33 Hockeborne ave., the building will be about 56x71 ft.

Canandaigua, N. Y.—Plans are under consideration by the Department of Public Works for the installation of a new electric street lighting system throughout the municipality. Power for operation is furnished by the Rochester Railway & Light Co. The system would include new concrete lighting standards placed about 100 ft. apart.

Greenwich, N. Y.—Consolidated Electric Co., Greenwich, Washington county, has filed notice with the secretary of state of an increase in its capitalization from $150,000 to $210,000, to provide for general expansion.

Lockport, N. Y.—The lamps and gas committee in its report to the aldermen recommended that the three-year proposal of the Lockport Light & Heat Power Co. to light the streets of the city at the rate of $57.50 per lamp per year be accepted and suggested that the council take up the matter of a municipal lighting plant for the city.

Oneida, N. Y.—Fire recently damaged a portion of the local power plant of the Morrisville Electric Light & Power Co., with loss estimated at about $5000. It is understood that immediate repairs will be made.

Rochester, N. Y.—Common Council has recently passed an ordinance providing for the installation of additional electric lighting units on Oxford and Dartmouth streets, to facilitate the present service.

Troy, N. Y.—Common Council has approved an appropriation of $145,000, to provide for the installation of a new and modern police-fire alarm signalling system throughout the municipality. Of this sum, $125,000 will be utilized for the installation of the system, while the remaining $20,000 is to provide for the erection of a new central station at Seventh and State streets.

Port Henry, N. Y.—In the near future the Port Henry Light & Power Co. will erect a new power plant and dam, two miles west from this village at a cost of $250,000.

Belleville, N. J.—In connection with the construction of the proposed local plant of the Overland Tire Co., 15 River street, for the manufacture of rubber tires, estimated to cost $90,000, considerable electrical and mechanical equipment will be required for operation.

Cape May, N. J.—United States government has had plans prepared for the installation of a new central heating plant with equipment at the local Government station. Commander J. D. Robnet, Senior Member, Board of Survey, Appraisal and Sale, Navy Yard, Philadelphia, Pa., is in charge of the work.

Irvington, N. J.—Final contracts have been awarded by the Atlantic Chemical Co. for the construction of the proposed group of factory buildings at 1190 Grove street. The plans include the construction of a large boiler plant department, to be used for general works operation. Hughes & Horton, Essex building, Newark, are architects for the company in charge of construction.

Newark, N. J.—Radel Leather Manufacturing Co., Wilson avenue, has awarded a contract to the Reynolds Construction Co., 308 South Ninth street, for the erection of a new boiler plant at its works. The structure will cost about $6000.

Newark, N. J.—A four-story plant, 60 x 80 ft. will be erected by the General Electric Co. at a cost of $66,000.

Newark, N. J.—In connection with the construction of the new plant of the New Jersey Pull Clean Towel Co., to be located in Halleck street, plans have been prepared for the erection of a boiler plant for factory operation.

Newark, N. J.—American Platinum Works, 231 New Jersey Railroad ave., has completed foundation work for the construction of the proposed factory and boiler plant to be located at Oliver and New Jersey Railroad avenues. The new works will provide for increased operations. Frederick Kilgus, 13 South Sixth street, Newark, is the building contractor.

Paterson, N. J.—Large quantities of electrical and mechanical equipment will be utilized in connection with the construction of the new municipal garbage incinerating plant, plans for which are now under consideration by the Board of Public Works.

Phillipsburg, N. J.—In connection with the construction of the new local sewage disposal plant by the city estimated to cost $137,980, contract for which has just been awarded, considerable new electrical and mechanical equipment will be required.

Pompton, N. J.—New York Telephone Co. has commenced the removal of its pole line to its new lines on the Newark-Pompton turnpike, now in course of construction by the state highway department.

Trenton, N. J.—The new power plant now in course of construction at the plant of the Trenton Malleable Iron Co., New York avenue, is rapidly nearing completion, and it is expected that operations will be inaugurated at an early date. S. W. Mather & Sons, Trenton, are the building contractors. The structure is estimated to cost $20,800.

Trenton, N. J.—Application has been filed with the Board of Public Utility Commissioners by the Bell telephone interests for approval of the increased telephone rates fixed by Postmaster General Burleson while the telephone lines were under federal control. The company is planning to increase the rates of the Delaware & Atlantic Telegraph & Telephone Co. by approximately 25% after Dec. 1.

Frankford, Del.—Prominent local business interests are taking active steps for the organization of a new company to engage in the generation and distribution of electric energy. It is proposed to construct a new local power plant, as well as install a new electric street-lighting system.

Millsboro, Del.—Plans are under consideration for the installation of a new electric street-lighting system.

Allentown, Pa.—International Motors Co. will erect an addition to its plant, two stories, 300 x 600 ft. Estimated cost $1,000,000.

Allentown, Pa.—City council has passed an ordinance creating a division of electric lighting in the water department, as well as adopted a resolution directing the preparation of the necessary legislation whereby the water department will be enabled to raise the sum of $62,000, to be used for the construction of an electric light and power plant for municipal service.

Carlisle, Pa.—General construction for erecting a $150,000 power plant for C. H. Nasland & Sons, America and N. Moreland street, Philadelphia, has been let to J. S. Rogers, Co. Drexel building, Philadelphia, Pa. Complete electric installation to be made of dynamos, transformers, switchboard, etc.

Columbia, Pa.—Borough council has recently awarded a contract to the Edison Electric Co., Lancaster, for furnishing electric service for the operation of the municipal electric street lighting system for a period of five years.

Greensburg, Pa.—Penn Aluminum Co., Pittsburgh, will erect a plant here.

Philadelphia, Pa.—Electric Storage Battery Co., Nineteenth and Allegheny streets, has broken ground for the construction of the proposed one-story building, to be located at 19th and Willard streets. The structure will be about 32x97 ft., and is estimated to cost $14,000. William Steele & Sons Co., 1600 Arch street, is the contractor.

Pitman, Pa.—The sum of $75,000 will be expended for improving the municipal light plant.

Baltimore, Md.—Chesapeake & Potomac Telephone Co. has announced the opening of a new telephone central office, located in the building at 5 Light street, to be known as "Calvert" exchange. The cost of the installation of the new switchboard, with accessory equipment, is placed in excess of $150,000.

Baltimore, Md.—In connection with the construction of the proposed packing plant of the William Schluderberg & Son Co., to be erected at Baltimore and Fifth streets, 339x414 ft., estimated to cost approximately $300,000, considerable new electrical and mechanical equipment will be required.

Cumberland, Md.—Application has been filed with the Public Service Commission by the Potomac Edison Co., for permission to take over and consolidate the electric and gas utilities of this city, including the street railway system and the Edison plant which furnishes light, heat and power with the company's plant at Grafton, W. Va. Included in the proposed consolidation is the plant of the Hartland Co., Hartland, W. Va., and the operations of the natural gas companies which supply this territory from the Central West Virginia field.

DATES AHEAD.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Ell C. Bennett, St. Louis, Mo.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

Danville, Va.—W. V. Young and Thomas S. Jones, Chatham, Va., are understood to have completed negotiations for the purchase of the plant of the Chatham Light & Power Co. for a consideration of about $17,000. It is said that the new owners are planning for operations on an increased scale.

Norfolk, Va.—A plant will be erected by the Norfolk Electric Manufacturing Co. P. O. Sutton, 215 Cumberland street, is general manager.

Laurens, S. C.—$200,000 bonds have been voted for extending the lighting and water systems. Address mayor.

Jacksonville, Fla.—W. L. Griffs and associates will establish an electric light plant at Atlantic Beach to furnish lights to cottagers.

Millville, Fla.—W. L. Wilson, Panama City, and associates, are planning for the construction of a new local electric plant with a five-mile transmission system extending to Panama City, the entire work being estimated to cost about $100,000. Thomas L. Johnston, Panama City, is engineer for the project.

Mount Dora, Fla.—Issuance of $27,000 municipal electric light and water bonds was voted. O. W. Sadler, mayor.

St. Petersburg, Fla.—The Ford Service Station is in the market for five 7½ and 10 hp. electric motors.

Pelham, Ga.—The council has contracted for power with the Gwyer-Alabama Power Co., the corporation which recently bought the Albany Power & Manufacturing Co., and is now building a much larger plant across the Flint river whereby that company will furnish electric power for Pelham's business houses, homes, streets and industries.

NORTH CENTRAL STATES.

Cleveland, Ohio—Architect R. Thompson, 6110 Euclid avenue, has prepared plans and will let contract for $50,000 concentrator station. Specifications include electrical machinery, electric power generating machinery, etc., to be erected by Cleveland Railroad Co., 700 Leader News building.

North Canton, Ohio—Hoover Suction Sweeper Co. is having plans prepared for an addition to its plant. The structure will be four stories, 80 x 170 ft., and will cost $125,000.

Port Clinton, Ohio—Ohio State Rubber Co. will erect a 100 x 300 ft. power plant. The specifications include electric power plant equipment and machine shop equipment, $15,000 to be expended. N. A. Bruess, president. Architect M. C. Millock, Sandusky, Ohio, has prepared plans.

Evansville, Ind.—Bucyrus Steam Shovel Co. will double its working capacity and will also build a hospital for the workmen, the total cost of the improvements to be $500,000. The company employes 400 workmen and is arranging to employ night shifts.

Fort Wayne, Ind.—Fort Wayne Engineering & Manufacturing Co. has increased its capital stock $200,000, the total capitalization now being $500,000 instead of $300,000. H. C. Paul is the president of the company.

Terre Haute, Ind.—The machine shop of the American Car & Foundry Co. burned with loss estimated at $100,000. Rebuilding will be begun as soon as the insurance is adjusted.

Terre Haute, Ind.—Bowen Motors Railway Corp. has completed plans for the erection of a plant to produce its gasoline propelled passenger car for use on steam roads for short runs.

Valparaiso, Ind.—McGill Manufacturing Co., manufacturer of electrical supplies, has under consideration the erection of a three-story plant, 65 x 260 ft., to cost $150,000.

Chicago, Ill.—Gulbransen-Dickinson Co. will shortly erect a six-story and basement addition to its present factory. The building will be of reinforced concrete and brick, with a frontage of 250 ft. and will embody the latest ideas in modern factory arrangement and equipment.

Chicago, Ill.—H. Channon Co., manufacturer of machinery supplies, will erect a seven-story building at North Market and West Randolph streets, to cost $450,000.

Chicago, Ill.—Gloria Light Co. will build a four-story factory building on property, 84x125 ft., in Sangamon street, which will cost about $75,000.

Deer Creek, Ill.—Deer Creek Power & Light Co. will construct and operate an electric light plant.

Fairbury, Ill.—A committee has been appointed to secure funds for ornamental lighting for streets. W.

A. Roth, president of commissioners.

Freeport, Ill.—H. W. Horst Co., Rock Island, Ill., is building a five-story and basement building for the Furst McNess Co., manufacturing chemists.

Galesburg, Ill.—Rowe Manufacturing Co. will build new reinforced steel and brick factory building. Company will also install a bolt factory for making all the bolts used in its manufacturing. The company will also extend the saw tooth building and when completed it will be 114 by 400 ft. Other improvements include the extension of the loading track. Six acres of land have been acquired for the extension of the plant.

Minier, Ill.—A new electric light company will incorporate for the purpose of installing an electric light plant and bringing current from the traction system. Address G. E. Peine.

Springfield, Ill.—At the November election the question of issuing $400,000 in bonds in aid of the municipal plant will be submitted to vote.

St. Charles, Ill.—The council has passed an ordinance authorizing an issue of bonds for improving electric light plant. The work will be done at once. Address city clerk.

Vandalia, Ill.—Consulting Engineers Fuller & Beard, 721 Olive street, St. Louis, have prepared estimates for improvements to light and water systems. $140,000 will be expended. Address city clerk.

Waukegan, Ill.—Allied Masonic orders will erect a $100,000 Masonic Temple.

Chilton, Wis.—Aluminum Specialty Co. has awarded contracts for a factory and power house, two story, 60 by 200 ft., to cost $40,000.

Fond du Lac., Wis.—Northern Casket Co. will build a new power plant for its factory at Fond du Lac. E. E. Dillon, Madison, Wis., has been retained as consulting engineer and is drawing the plans and specifications for the plant.

Stoughton, Wis.—M. A. Kimball has a contract and will erect a power plant for the city. Power equipment will be purchased. L. C. Currier, clerk.

Kalamazoo, Mich. — Engineers Woodmansee & Davidson have prepared estimates for improving electric light plant. The question of issuing $1,200,000 bonds will be submitted to vote at the November election. A. Sonderenk, city clerk.

Three Rivers, Mich.—Nillingham & Cobt, Press building, Kalamazoo, Mich., have prepared plans for a 5-story, 380 x 175 ft., power plant and paper mill to be erected by Eddy Paper Co. Specifications include paper machinery, equipped with generators, transformers, etc. Address C. E. Nelson, manager, Three Rivers, Mich.

Dubuque, Iowa—A physical appraisement of the property of the Dubuque Electric Co. will be made by the Stiver Auditing Co., Des Moines, Iowa. This work is in addition to an audit of the books of the company. The entire task of appraisement and auditing is being done in order to arrive at a correct idea of what increased rates should be allowed the company. The company will pay one-half of this expense and the city one-half.

Elkhart, Kans.—Excavation has been begun for a settling basin, and for the foundation of a new power house for the city water and electric light plant. The city recently voted $60,000 bonds for the extension of the plant.

Kansas City, Kans.—$150,000 electric light bonds will be offered for sale. The bonds will be issued for improvements at the electric light plant, which will practically double its capacity. Of the $500,000 voted, $250,000 already have been sold.

Kansas City, Mo.—Kansas City Bolt & Nut Co. will expend in excess of $1,000,000 for additions to its plant, increasing its monthly capacity to 65,000 tons by next March. Five open-hearth steel furnaces, each of 50-ton capacity, 22-in. rolling mill, with traveling tilting tables and overhead cranes and electric power will be installed.

St. Louis, Mo.—Wagner Electric Manufacturing Co., 6400 Plymouth avenue, is arranging for the construction of a new five-story addition to its plant, about 160x400 ft., to provide for increased capacity.

SOUTH CENTRAL STATES.

Benton, Ky.—City council is understood to be arranging plans for the immediate installation of a new electric light plant, to be used for municipal service.

Greenfield, Tenn.—The city has voted $70,000 bonds for water and electric light plants. Address Clyde Ezzell, mayor.

Knoxville, Tenn.—Tennessee Mills will expend from $75,000 to $100,000 for building a two-story, 70x30-ft. addition to its plant and install new underwear knitting machinery.

Lebanon, Tenn.—Tennessee Power Co., Nashville, will erect a transmission line from Lebanon to Murfreesboro.

Irondale, Ala.—City has approved a bond issue of $5000 to cover the cost of the construction of a new transmission line to Birmingham. J. W. Richards is mayor; F. O. Floyd is engineer.

Lexington, Miss.—Issuance of $20,000 of municipal bonds for electric light purposes was voted. W. J. Jordan, city clerk.

Natchitoches, La.—City commissioners are having plans prepared by Xavier A. Kramer, consulting engineer, Magnolia, Miss., for alterations and improvements in the municipal light and water plant. It is proposed to install new alternators, engine and pumping equipment, and arrange for the construction of a new power station building. F. W. Johnson is mayor.

Horatio, Ark.—The city contemplates the installation of electric light and water plants. Address the mayor.

Ponca City, Okla.—$50,000 in bonds have been voted for electric light extension. Address W. H. McFadden, mayor.

Kyle, Tex.—Kyle Power & Light Co., recently incorporated, is arranging plans for the construction of a power plant for local service. C. F. Heidenreich is manager.

Waco, Tex.—Central Texas Electric Railway Co., recently incorporated with a capital of $500,000, is arranging plans for the construction of an electric railway system from Waco to Temple for passenger and freight service. It is said that the plans will include the ultimate construction of an extension to Austin, and thence to San Antonio. The board of directors is as follows: J. L. Davidson, O. A. Rifle, and S. M. Clark, all of Waco; P. A. Clark, Rosenthal, Tex.; Henry Meisner, G. E. McSelver, and H. L. Dailey, Temple, Tex.

Sadler, Tex.—H. L. Kinney, Grayson county, advises that a chamber of commerce has been organized and a franchise granted to a Denison firm for the immediate erection of an electric light plant at Sadler.

Wichita Falls, Tex.—In order to provide electric power and lights for a wide scope of territory in northwest Texas the Wichita Falls Electric Co. will greatly enlarge its central power station here and extend its transmission line to a number of cities and towns. It is stated that the proposed improvements will cost about $1,000,000. The company is already furnishing electric power for oil well pumping plants in the Burkburnett district and for other industries of this city and adjacent section.

WESTERN STATES.

Missoula, Mont.—Missoula Light & Water Co. will expend about $85,000 in remodeling its power dam in the Missoula river near Milltown. H. L. Bickenbach will have charge of the work.

Nampa, Idaho—The installation of a boulevard lighting system to replace the lights in use is being considered by the Nampa Chamber of Commerce.

Ogden, Utah—Application has been made by the Uintah Power & Light Co. for a preliminary permit for the construction of an electric generating station on the Uintah river, to furnish 4000 hp. The plant would be situated on the Uintah river in the Ashley forest and distribute power to all of the towns in the Uintah basin. If the permanent permit is granted the right of occupation for 50 years is granted.

Roseburg, Ore.—Roseburg will have a municipal lighting and power plant, according to plans of the city council. Mayor Hamilton with Claude Frear, city engineer, located a fine power site on the North Umpqua river, east of the mouth of Rock creek, 25 miles east of the city.

Rio Vista, Cal.—Plans are being completed for the construction of a 22,000-volt power line from Hood to Franklin by the Great Western Power Co., this work to cost about $20,000. Most of the power will be used for pumping water, which is needed for the big agricultural development in the Franklin district.

CANADA.

Hamilton, Ont.—International Plow Works has under consideration the erection of a manufacturing plant. B. H. Prack, Lumsden building, Toronto, engineer.

New Toronto, Ont.—Goodyear Tire & Rubber Co. of Canada, Ltd., will erect a $200,000 addition to its factory. Plumbing, heating and electrical contracts will be let.

Coquitlam, B. C.—Gregary Tire & Rubber Co., Vancouver, plans the erection of a factory to cost $175,000. Gardiner & Mercer, 827 Birke building, Vancouver, architects.

PROPOSALS

Light and Water Plant.—Bids will be received Oct. 13 for the construction of a water and light plant at Ansonia, Ohio. G. L. McKibben, of Van Wert, has prepared plans. Address city clerk.

Water-Tube Boiler.—Bids will be opened in the Treasury Department, supervising architect's office, at 3 p. m., Oct. 28 for an additional 200-hp. water-tube boiler at the Bureau of Engraving and Printing, Washington, D. C., in accordance with drawings and specifications, copies of which may be had at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Pneumatic-Tube System.—Bids will be opened at 3 p. m., Oct. 27, in the office of the supervising architect, Treasury Department, Washington, D. C., for a pneumatic-tube system in United States assay office at New York, N. Y. Drawings and specifications may be obtained from the supervising chief engineer, Room 731, United States Customhouse, New York, N. Y., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Work.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Nov. 28, for furnishing materials for the construction of the United States post office at Gilmer, Tex., including materials for concrete, reinforced concrete, stone, granite, brick, structural terra cotta, structural steel, miscellaneous iron and steel work, composition roofing, slate roofing, sheet-metal work, plastering, interior marble, sanitary slate, lumber, millwork, painting, glazing, hardware, plumbing, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto. Copies may be obtained after Oct. 23 from the custodian of the site at Gilmer, Tex., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Conduit.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Nov. 10 for furnishing the labor required in the construction complete (including heating, plumbing, electric conduits, and wiring) with material that will be furnished by the Government, for kitchen and mess hall, officer's quarters, attendants' quarters and garage and approaches, for the United State marine hospital at San Francisco, Cal. Drawings and specifications may be obtained from the superintendent of construction, room 403, post office and courthouse, San Francisco, Cal., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Hydroelectric Machinery.—Board of Public Works, Seattle, Wash., is asking for sealed bids up to 10 a. m., Oct. 17, for hydroelectric machinery required for an additional unit at the city's Cedar Falls hydroelectric station. The requirements are for a 10,000-kw. generator, alternating current, revolving field, 3 phase, 60 cycles, 6600 volts. Generator is to be direct-connected to water wheel, and to withstand for one hour runaway speed of water wheel, without injury to machine. Water wheel may be of impulse or reaction type, with horizontal or vertical shaft, and may have more than one runner. It is to be driven from a 78-in. penstock, 7500 ft long. Capacity of wheel shall be not less than 16,000 hp., with a speed not to exceed 515 r. p. m.; other requirements include a 200-kw. exciter unit, consisting of a direct-current generator, direct-connected to a water wheel, the latter to be driven from a steel penstock, supplied with water from the main penstock through a connecting tap. All necessary accessories are to be included in bids submitted.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Engines (30,761).—An American exporting company desires to purchase suitable engines and boilers of a type necessary for running a rice-milling plant. Its requirements are a small, compact steam-power plant consisting of horizontal tubular (preferably portable) fire-box boiler with engine mounted on same and connected to boiler, in two sizes, 30 and 50 hp. References.

Motors, Dynamos, Wire, Electrical Appliances (30,646).—A Spanish merchant established in the United States, having representatives in Spain, is about to visit that country and desires to secure agencies for the sale of tools, hardware, lathes, electrolytic copper wire, iron plates, motors, dynamos, electrical appliances, paints, chemicals, drugs, and crometanned upper leathers. References.

Electric Lamps (30,729). — An agency is desired by a man in Italy for the sale of electric lamps, hardware, oilcloths, linoleum, toys and drawing instruments. Quotations should be given c. i. f. Italian port. Correspondence should be in Italian or French. References.

Engines (30,736).—A manufacturing firm in France desires to secure exclusive agencies for France and her colonies of agricultural implements, including tractors and internal combustion engines. Correspondence may be in English.

INCORPORATIONS

Queens, N. Y.—McPhilben Lighting Fixture Co. Capital, $43,000. To manufacture electric and gas fixtures, etc. Incorporators: H. Schneider, M. Malk, and B. Schaefer, Queens.

New York, N. Y.—New York Power, Steam & Engineering Co. Active capital, $52,500. To engage in a general electrical and mechanical engineering capacity, etc. Incorporators: S. E. Trumbull, T. W. Barnes, and A. V. Clements, Albany.

Schroon Lake, N. Y.—Schroon Lake Lighting Corp. Capital, $30,000. To operate a local electric light plant. Incorporators: B. F. Stetson, M. C. Stanton, and R. B. Dudley, Elizabethtown.

Phoenix, N. Y.—Northern Cayuga Light & Power Corp. Capital, $50,000. To operate an electric light and power plant and distributing system in the Phoenix district. Incorporators: Frank Longley, C. E. Dudley, and James D. Bloomfield, Meridian, N. Y.

Wilmington, Del.—Glascox Electric Co. Capital, $10,000. To operate a local electrical engineering establishment. Incorporators: George G. Steigler, W. F. O'Keefe, and J. H. Dowdell.

Beckley, W. Va.—Beckley Machine & Electric Co. Capital, $25,000. To manufacture machinery, electrical specialties, etc. Incorporators: A. J. Truman, W. E. Griffiths, J. T. Evans, J. L. Smith, and J. S. Lilly, Beckley.

Paducah, Ky.—Suburban Electric Supply Co. Capital, $30,000. To manufacture electrical supplies. C. B. Smiley is the principal incorporator.

Gilbert, Iowa—Gilbert Electric Co. has filed articles of incorporation at the office of county recorder to be $15,000 divided into shares of $100 each, to be paid up in full. Address John Hill, president. The object of the incorporation is to erect, operate and maintain poles, wires and other equipment for the purpose of transmitting electrical energy for light, heat, power and other legitimate purposes, to sell and distribute such electrical current in and adjacent to the town of Gilbert.

Minier, Ill.—Minier Electric Light & Power Co. has been incorporated with capital of $15,000. Address George Peine.

Pine Village, Ind.—Pine Village Light & Power Co. has been incorporated with capital of $10,000 to supply light and power for the village of Pine Village. Address Melvin Akers, Pine Village, Ind.

Personals

Major Jackson Cited—P. S. Klees Becomes Vice-President of Pierce Fuse—Warner Jones Joins Dayton Fan & Motor

FRANK O'RYAN has been appointed district manager of the Allis-Chalmers Manufacturing Co. at Denver, Colo.

C. S. ANDERSON, formerly superintendent of the Clark Electric Power Co., Tooele, Utah, is now superintendent of the Butler district of the Western Pennsylvania Power Co.

MALACHI G. BRENNAN, advertising manager of the Sanford Riley Stoker Co., Ltd., Worcester, Mass., has been transferred to the sales department of the Chicago office of the company. He will be succeeded by Otis C. Sheldon.

LEWIS A. BELDING, who for the past two years has been assistant professor of mechanical engineering at Stevens Institute of Technology, Hoboken, N. J., is now associated with the Thomas A. Edison interests at Orange, N. J., in the power service division, as service engineer.

MAJ. JOHN B. JACKSON, an engineer with the Commonwealth Edison Co., Chicago, is the recipient of a citation signed by General John J. Pershing dated April 19, 1919, "for exceptionally meritorious and conspicuous service." Major Jackson was in the Corps of Engineers and was assigned to the office of Chief of Engineers, A. E. F. In the Division of Construction and Forestry he had direct administrative charge of electrical projects in France; that is, in all territory except the immediate fighting zone.

R. L. FRISBY, testing engineer of the Commonwealth Edison Co., Chicago, has resigned to become chief electrician for the Kansas City Light & Power Co. Mr. Frisby has been connected with the Commonwealth Edison Co. for about 16 years, during which time he has been connected with operation. For many years he has had charge of testing at the Fisk, Quarry and Northwest stations of the company. It has been through his efforts that numerous operating economies and safety methods have been adopted at these power houses of the company. In addition to testing and maintenance at the Fisk street generating station, Mr. Frisby has carried on a considerable amount of research work at the company's laboratories in connection with balance relays for generator protection, the use of noncombustible generator coils, the use of exploring coils versus thermocouples for determining "hot spots" and similar work relating to large turbogenerator stations. In Kansas City he will have charge of operating and maintenance of the entire system, where it is expected that his extensive experience with Chicago's large system will prove, alike, of service to himself and the Kansas City Light & Power Co.

WARNER JONES, formerly special representative of the National Carbon Co., Inc., and whose duties have called him to all parts of the country, is now sales manager of the Dayton Fan & Motor Co., Dayton, Ohio. He will have charge of the sales and advertising departments of the company and will be responsible for the advertising and sales of the Dayton fans and small motors. Mr. Jones has had 20 years' experience in selling various kinds of electrical merchandise, and the experience and acquaintanceship that he brings with him will undoubtedly be of great value to the Dayton Fan & Motor Co. He has many new ideas on the merchandising of electrical equipment that will doubtless be of great interest to electrical supply jobbers and dealers throughout the country as well as manufacturers of electrical apparatus who use small motors.

PETER S. KLEES has tendered his resignation as manager of the Franklin Incandescent Lamp Works of Westinghouse Lamp Co., New York City, to become associated with the Pierce Fuse Corp., Buffalo, as vice-president and sales manager. Mr. Klees has been prominent in the lamp industry for many years, having joined the organization of the American Incandescent Lamp Co. in 1899. In 1905 he went to Hartford as a member of the sales department of the Franklin Electric Manufacturing Co., later becoming sales manager and then also vice-president. He continued in this capacity until the sale of this company in 1918 to the Westinghouse Lamp Co., at which time he became manager of the Franklin Works and removed to New York City. Mr. Klees has a very wide acquaintance among electrical men throughout the country, who will be glad to hear that his new interest in the fuse field will still keep him in the industry.

COL. EDWARD A. DEEDS, president of the Domestic Engineering Co., Dayton, Ohio, was the principal speaker and guest at a dinner given in his honor by the Indiana section of the Society of Automotive Engineers at the Claypool Hotel in Indianapolis, Ind., Oct. 10. At the age of 26 Colonel Deeds joined the staff of the Thresher Electric Co. as assistant draftsman, becoming chief engineer and superintendent within a year. Shortly afterwards he went to the National Cash Register Co., where, as maintenance engineer, he built the power house and electrified the plant. Leaving that position he went to Niagara Falls where he built and put into operation the shredded wheat plant. On the completion of this work he returned to the National Cash Register Co. as vice-president in charge of engineering, remaining there until 1914. In April, 1917, he was called to Washington as a civilian member of the munitions standards board. Later he became a member of the aircraft production board and was placed in charge of the production division of the board's activities. In August, 1917, he was commissioned a colonel.

COL. T. H. DILLON of the Engineers Corps of the United States Army, has resigned from the army and his appointment to a professorship of Electrical Engineering at the Massachusetts Institute of Technology is announced, thereby adding his name to the already notable electrical engineering staff of that institution. Colonel Dillon graduated from the military academy at West Point in 1904, and was appointed to the Engineers Corps of the army. After some military duties he was assigned to the Engineer School of Application of the United States Army, from which he graduated in 1907. Since then he has had a wide, varied and notable engineering experience. He was in Cuba during the American occupation as assistant to the director of public works. He was occupied in the Philippines on the military survey of the Island of Luzon, part of the time being in charge of the work. Later he was located at Portland, Ore., in charge of the construction of the Dalles-Celilo canal around the Dalles of the Columbia river, and the roads in the Crater Lake National Park. He then was assigned to Panama and made electrical engineer of the Panama Canal and superintendent of the Gatun Locks. Here he was also in charge of engineering in the locks division and the hydrographic division. He had the unique experience of locking the first great ships through the Gatun Locks.

In 1918 he went to France as colonel in command of the 37th Engineers, which was the notable electrical and mechanical regiment whose reputation is widely known. In France he was deputy chief engineer of the First Army of the American Expeditionary Forces during the St. Mihiel, the Aisne-Marne and Argonne-Meuse campaigns, in charge of the mechanical and electrical work, water supply, general construction, army shops and engineers' supplies for the army throughout these notable campaigns. After the armistice, Colonel Dillon was made deputy to General McKinstry, who was the chief of the board of damages in allied countries, and as such he had charge of the plans for making the estimates for the American peace commissioners of personal and property damages suffered by the allies on account of the aggressions of the enemies in the war. Colonel Dillon brings a large fund of scientific training and engineering experience to his duties at the Massachusetts Institute of Technology, where he will make a specialty of instruction in the problems of electric railroads, including tramways and electrification of steam railroads and in the problems of power transmission.

For the Readjustment Period—What?

LIV.

Financing Foreign Trade

Commercial interests of the United States will be asked to unite and determine on a definite plan of action regarding trade with other countries at a conference of business men of the country, to be held in New York Oct. 16 and 17.

The conference, which will be held under the auspices of the American Manufacturers' Export Association, will discuss the export situation and also, it is expected, will devote considerable time to considering the lengths to which manufacturers are prepared to go in utilizing facilities for financing foreign trade provided by the Edge bill.

Among those interested in calling the conference are James A. Farrell of the United States Steel Corp., W. W. Nichols of Allis-Chalmers Mfg. Co., A. C. Bedford of the Standard Oil Co., E. M. Herr of the Westinghouse Electric Export Co., W. C. Durant of the General Motors Co., W. L. Saunders of the Ingersoll-Rand Co., F. A. Seiberling of the Goodyear Tire & Rubber Co., William H. Ingersoll of Robert H. Ingersoll & Brother, and Robert A. Shaw of the National Aniline & Chemical Co., Inc.

The widespread interest being taken in this effort to crystallize the views of business on foreign trade problems is regarded as a sign that American manufacturers and shippers, who have only recently entered the export field, are determined to make this international trade a permanent part of their business.

Factories which increased production during the war to meet abnormal demands are continuing to maintain their enlarged output because of orders from overseas. Not a few of the manufacturers who are operating on this basis declare that any great decline in the volume of the nation's foreign business is certain to bring depression and unemployment in its wake.

The accompanying reproduction of an announcement in the daily press calls attention to a matter of importance to manufacturers of electrical equipment. I hope it will have the consideration which it deserves.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

$10,000,000 Power Deal Authorized.

Hydroelectric development in California was given a decided impetus by the Railroad Commission recently when it approved the purchase of the properties of the Northern California Power Co. by the Pacific Gas & Electric Co. Approval of this transaction by the Railroad Commission, in addition to making possible a merger of power properties that will prove of great benefit to the state, will prevent threatened litigation that promised to block for years needed hydroelectric development. Its immediate effect will be to make possible the development of the Pit river project, a gigantic power scheme, held in abeyance by the Pacific Gas & Electric Co. because of threatened trouble with the Northern California Co. over water rights.

The order by the Commission makes possible a transaction involving an amount approximating $10,000,000, the approval covering the purchase by the Pacific Gas & Electric Co. of 10,000 shares of the Northern California Power Co. stock at $34 a share and the assumption by the gas company of the power company's obligations totaling $6,213,526.74. The Pacific Gas & Electric Co. is willing to pay for the stock forthwith and has agreed to pay for the properties on or before Dec. 1, 1948, the sum of $3,400,000, in addition to assuming the Northern company's obligations.

Northern California Power Co. generates and distributes electric energy in portions of the counties of Shasta, Trinity, Tehama, Colusa, Glenn and Butte. It sells water in Redding and Willows, and manufactures and distributes gas in Redding, Red Bluff and Willows. The company's engineer estimates that to reproduce the properties at present day prices would cost $13,300,000. Its listed assets total $18,471,668.36.

As further evidence that the transaction is for the best interests of the Northern company's stockholders, the commission points out that from 1913 to 1918 the company paid no dividends but levied assessments totaling $1,400,000. Up to May 31, 1919, it was in arrears $225,029.80 in sinking fund payments, owned notes amounting to $249,250 and would have to meet, in February, 1920, maturing debentures aggregating $370,000. Taking into consideration the Pit river project, and the required expenditure of $6,000,000 for the first unit of this development, the commission says:

"An expenditure of from $6,500,000 to $7,000,000 must be made to keep Northern California Power Co. a solvent up-to-date public utility corporation and able to discharge its obligation to the public. There is no doubt that an entirely new financial program would have to be devised by the company to install even the first unit of the Pit river development."

Rochester Railway Issues Stock.

Rochester Railway & Light Co. has completed arrangements for the issuance of 6% cumulative preferred stock for $500,000, a portion of the proceeds to be used to increase the present service facilities of the company. The company has recently commenced the changing of the system used at the present time from direct to alternating current, it being held that the latter system is preferable for long distance transmission, with greater efficiency at a lower cost of production.

Hurley Machine Votes Capital Change

Stockholders of the Hurley Machi[ne] Co. at a special meeting held last wee[k] to change the capitalization of [the] pany from 15,000 common sha[res] par value to 200,000 shares [of] par value. No change was made in [the] preferred stock issue, which is 5000 shares of $100 par value.

It also was voted to increase the directorate from five to nine members, the new directors elected being Edward F. Carey, president of the Haskell-Barker Car Co.; Joseph E. Otis, vice-president of the Central Trust Co. of Illinois; Silas Strawn of Winston, Strawn & Shaw, and Edward N. Hurley, Jr., president of the Hurley Supply Co.

The directors have also directed that the present outstanding 11,650 common shares be called for cancellation and exchange for the new common stock on the basis of seven shares of new stock for one share of old common. The exchange will be made with stockholders of record Oct. 15, who also will be offered the right to subscribe to 10,000 shares of new stock at $35 a share. The proceeds from the sale of stock will be used for plant extensions.

Brazilian Traction Note Issue.

An issue of $7,500,000 Brazilian Traction, Light & Power Co. three-year 6% secured gold notes is being offered at 92½ and interest to net about 7% by the Continental and Commercial Trust and Savings Bank and William A. Read & Co., Chicago. The notes are dated Nov. 1, 1919, and mature Nov. 1, 1922. The total authorized issue is $10,000,000. The company agreed to pay the United States normal income tax up to 2% if exemption is not claimed by the noteholder.

Public Service Notes Offer.

Halsey, Stuart & Co. are offering $2,500,000 Public Service Co. of Northern Illinois three-year 6% collateral notes, series C. due Sept. 1, 1922, at 98 and interest, yielding 6¾%. A part of the proceeds of this issue will be used to pay off the $1,500,000 two-year 6% notes of the company. The balance of the proceeds will reimburse the company for expenditures made, or to be made, for improvements and extensions. The notes were all sold within an hour after the books were opened. The syndicate underwriting was very largely oversubscribed.

Dividends.

Carolina Power & Light Co. has declared a quarterly dividend of 1½%, payable Nov. 1 to stockholders of record Oct. 15.

A quarterly dividend of 1¾% on preferred stock has been declared by the Fort Worth Power & Light Co., payable Nov. 1 to stockholders of record Oct. 21.

Babcock & Wilcox Co. has declared a quarterly dividend of 2%, payable Jan. 1 to stock of record Dec. 20.

Southern New England Telephone Co. has declared a quarterly dividend of 1¾%, payable Oct. 15 to stock of record Sept. 30.

A cash dividend of 75 cts. per share on preferred stock has been declared by the Puget Sound Traction, Light & Power Co., payable Oct. 15 to stock of record Oct. 2.

A dividend of 1¾% has been declared by the Public Service Co. of Northern Illinois, also a dividend of 1½% on preferred stock, both payable Nov. 1 to stock of record Oct. 15.

Chicago Pneumatic Tool Co. has declared a quarterly dividend of 1½%, payable Oct. 25 to stock of record Oct. 15.

Illinois Northern Utilities Co. has declared a dividend of $1.50 a share on preferred stock, payable Nov. 1 to stock of record Oct. 20.

Sullivan Machinery Co. has declared a quarterly dividend of 1½% with the usual extra dividend of 1%, both payable Oct. 15 to stockholders of record Oct. 1.

A quarterly dividend of 2% has been declared by the Kaministiquia Power Co., payable Nov. 15 to stock of record Oct. 3.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Sept. 30.	Bid Oct. 7.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	77	78
American Gas & Electric of New York, common	10+extra	118	127
American Gas & Electric of New York, preferred	6	40	40½
American Light & Traction of New York, common	..	215	220
American Light & Traction of New York, preferred	6	94	94
American Power & Light of New York, common	4	..	..
American Power & Light of New York, preferred	6	..	..
American Public Utilities of Grand Rapids	..	5	..
American Public Utilities of Grand Rapids, preferred	7	25	25
American Telephone & Telegraph of New York	..	99½	99½
American Water Works & Elec. of New York, common	..	5	4
American Water Works & Elec. of New York, particip	7	10	20
American Water Works & Elec. of New York, first preferred	..	59	55½
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	21	25
Cities Service of New York, common	+extra	483	471
Cities Service of New York, preferred	6	77	76½
Commonwealth Edison of Chicago	8	107	108
Comm. Power, Railway & Light of Jackson, common	..	20	21½
Comm. Power, Railway & Light of Jackson, preferred	6	49	49
Federal Light & Traction of New York, common	..	7	10
Federal Light & Traction of New York, preferred	..	47	58
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	..	30	29
Middle West Utilities of Chicago, preferred	..	50	50
Northern States Power of Chicago, common	..	65	65
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	68	66
Pacific Gas & Electric of San Francisco, preferred	6	88	89⅝
Public Service of Northern Illinois, Chicago, common	7	85	85
Public Service of Northern Illinois, Chicago, preferred	6	87	91
Republic Railway & Light of Youngstown, common	4	11	9
Republic Railway & Light of Youngstown, preferred	6	47	45
Standard Gas & Electric of Chicago, common	..	31	31
Standard Gas & Electric of Chicago, preferred	8	41	40
Tennessee Railway, Light & Power of Chattanooga, common	..	5	4
Tennessee Railway, Light & Power of Chattanooga, preferred	6	13	10
United Light & Railways of Grand Rapids, common	4	43	44
United Light & Railways of Grand Rapids, preferred	6	70	70
Western Power of San Francisco, common	..	24	23
Western Union Telegraph of New York	extra	83	83
Industries.			
Electric Storage of Philadelphia, common	4	98	119½
General Electric of Schenectady	8	164	165
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54¾	54¾